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TIME SERVICE BY WIRELESS TELEGRAPHY.

An interesting suggestion has received some attention in Paris, and has even been discussed by a number of scientific men. This is the proposal to employ the Eiffel Tower, at Paris, for distributing time signals over the entire world. The idea is that, since the distance of transmission of wireless signals is a function of the height of the antenna, as well as of the power available for radiating the waves, the opportunity exists at the tower for establishing the most powerful wireless station in the world, which would be beneficial to all, but particularly to navigators, if use were made of this opportunity for signaling the instant at which the sun crosses the meridian of Paris. If this could be done, seamen would be rendered more or less independent of the chronometer, and the gain to navigation would be great. Of course, only those vessels provided with suitable apparatus for receiving these signals could take advantage of them, but there are now few large ships not fitted with wireless telegraphic equipment, which is becoming more and more a necessity. The proposed time signals would also be of considerable value on land, as has been clearly shown by the system of signals now in force in this country.

There is some question, of course, whether it would be possible at the present time to transmit these signals over the entire world, but the experience in sending messages across the Atlantic and through other great distances seems to show that, with sufficiently powerful waves of the proper character, success would be attained. It is true that some hold that while it may be possible to send these waves over the comparatively low hill between Ireland and North America, it is an entirely different matter to send them half-way around the globe. On the other hand, if these waves glide over the surface of the earth, they would consist first of diverging, and then converging, waves, and hence at the antipodes would result in an electrical splash. Therefore, if a distance of 6,000 miles, say, can be covered satisfactorily, it should not be impossible to read the signals at any point beyond this, though it may be that the loss in energy due to the guiding effect of the earthen air might be greater than the increasing intensity of the effect due to the convergence of the waves.

There is another factor which would become important should the attempt be made to send out the proposed time signals. It will be necessary, of course, that they be enormously powerful; hence they are likely to interfere with the sending of commercial or official messages. To avoid this complication, there are two alternatives; either the character of the signals must be such as not to cause interference, and such that they

can be distinguished clearly from all other signals; or all other wireless transmission must be held up at the time the signals are to be sent. The latter is the plan followed in this country by the Western Union Telegraph Company in sending out time signals from Washington. All commercial service is stopped for five minutes preceding the noon hour. The latter plan would cause but little inconvenience and, in most cases, none at all, since it would probably be desired to receive the time signals themselves. Moreover, it would render the wireless telegraphic apparatus already installed on shipboard and elsewhere available for this purpose without the addition of special appliances. It would be interesting, indeed, if this plan of sending signals should be tried, and there is little doubt that interesting results would be obtained, even should the time-distributing system itself be found not to be feasible.

THE ACTION OF RECTIFIERS.

In a recent address on "Electric Discharges Through Gases," delivered by Professor J. J. Thomson before the Royal Institution, of London, the lecturer discussed the various phenomena which may be observed when an electrical spark is caused to pass between two electrodes by means of the intervening gas. He showed how the voltage required to force this spark to jump first varies with the length of the gap and the gas pressure, but is independent of the nature of the electrodes, as long as the gap is comparatively long. When, however, it becomes short—that is to say, conveniently measurable in wave lengths of sodium light—the character of the electrode itself affects the potential. The phenomena observed here seem to indicate that the discharge is first caused, not by an ionization of the gas, but by the actual pulling out of electrons from the cathode. When a discharge takes place in a vacuum tube there is found to be a minimum potential necessary to cause the spark to jump, and it is noticed that the cathode is surrounded by a dark space beyond which is the so-called negative glow. Now, if a second cathode, not connected to the first, be introduced into the tube and moved up until it touches the dark space, it is found that a discharge can not take place until the potential is raised by another 300 volts. The explanation is that this potential is necessary to draw the negative electrons out of the cathode, and in their flight through this dark space, they encounter the molecules of gas which they ionize, and thus produce the first bright striation. If, however, the second cathode be interposed so as to prevent this ionization, and it, itself, receives the first shower of electrons, it is necessary to do this work over again at the other surface of the second cathode, since the work done at the first was not allowed to render the air conductive. If, now, the second cathode be pierced by a small hole, the discharge will take place at about the original potential, but it will pass through this hole, and not to the second cathode.

The resistance of a column of gas from a cathode dark space up to the anode is small compared with that of the dark space itself. Hence, if the two electrodes are brought together, the effect is merely to cut off more or less of this space without affecting the dark space and without changing the resistance of the tube much; and if the two electrodes be brought still closer together, so that the anode touches the dark space, the resistance of which is great, it is not found that the fall of potential through the tube will be decreased, because by this action it has been rendered difficult to ionize the gas. In fact, the closer together the two electrodes are, the greater the potential difference required to cause the spark to pass.

These facts are thought to have an application in the construction of what are known as "rectifiers" or "electrical valves," since these usually consist of two electrodes, one having plenty of room around it, while the other has but a small discharging area. When the latter is acting as anode, there is ample room for the dark space to be formed around the larger cathode, and thus the intervening gas is rendered conductive. When the conditions are reversed, so that the smaller electrode is required to act as cathode, there is little or no room for this dark space to be formed; hence the action upon the gas is small and the resistance to the passage of current is high. This produces the asymmetrical character of the arrangement which makes it useful as a rectifier.

INEXPENSIVE POWER-PLANT ECONOMIES.

Owners of isolated plants whose operating costs are high sometimes fail to realize that economies can be effected without great expense, if a careful examination is made of the working conditions of their installations. When large outputs are involved and where the plant cost is high in the first place, it is peculiarly desirable to reduce the expenses of operation to as low a point as is consistent with reliable service. When the conditions are complex the employment of a consulting engineer of standing to report upon the situation and to advise betterments is always desirable, but before calling in the specialist it is well to make sure that the fundamental principles of good operation are not being violated.

In a plant rated at about 150 kilowatts recently examined, one of the most modern installations of individually motor-driven machinery in the country in that particular industry was thoroughly looked over, and in investigating the motor layout the power-house end of the plant was also looked into. It was surprising to find that with the best methods of machine driving went defects in the power-plant practice which menaced the entire installation's effectiveness as an efficient industrial plant. The boiler-room floor provided the only possible coal storage of the property, though the plant was located in a suburban district. Several wagon-loads of coal had to be teamed into the plant to supply the fuel for each day's run, and with no reserve supply of coal the entire establishment was open at any time to the handicap of strikes, blockades, breakdowns and irregular deliveries at disadvantageous prices per ton. A shut-down of the whole plant would in a few hours follow the cessation of coal deliveries. The boiler room itself was too small to allow the storage of more than a few tons at a time.

The lighting of both boiler and engine rooms was inadequate for good operation; the live steam piping from the boiler out-

lets to the engine and pump cylinders was entirely bare; the switchboard circuits were not labeled; open link fuses were mounted on the fronts of the marble panels, and in some parts of the plant the motor rheostats and controllers were exposed to steam vapors and condensation, water from washing machines, and general refuse accumulation, without being boxed in.

In another plant examined about the same time a nine-inch live-steam main serving a 1,500-horse-power engine was not lagged on the boiler-room side of the engine stop valve, the main header was protected by no insulated covering, and no means was at hand for closing the engine-room door during the cold season. About twenty steam leaks were counted in various parts of the pipe installation, and the coal handling required the services of about a dozen men. The total rating of the plant was over 2,500 kilowatts. Records of coal consumption, outputs, labor, maintenance and supplies were inadequate for the proper observation of the plant's working. The output of the boilers was at the rate of three boiler-horse-power per kilowatt-hour—an abnormally high ratio, and although the plant contained compound condensing engines with a thoroughly modern barometric outfit, the cost of production per kilowatt-hour was close to two cents, exclusive of maintenance. The labor cost alone in this plant was as high as the total cost of power in similar-sized installations operated according to the best modern methods. The fuel consumption of the plant was about eight and three-quarter pounds per kilowatt-hour.

There would be little advantage in citing cases of this kind were it not for the possibilities of improvement which lie close at hand without the expenditure of considerable sums of money. The cost of insulated covering for live-steam piping is trifling compared with the annual saving in fuel; the expense of erecting a coal bunker of rough construction is far from serious compared with the economy of maintaining a reserve supply; the proper marking of switchboard circuits is a merely nominal matter in terms of expense; faulty illumination is unnecessary in any intelligently operated plant; and the protection of moving contacts from moisture is generally an inexpensive problem to solve. Simple but reasonably complete record blanks are by no means costly, and in some large stations their correct use has resulted in economies of many hundreds of dollars a month. The coal-handling problem is obviously one requiring experienced judgment for its economical solution, but by the installation of some form of telpher system and by turning to account the possibilities of gravity dumping it is generally feasible to reduce the cost of delivering fuel at the grates in all cases where the existing figure per ton is unduly high. Thus, in the second plant cited, a saving of about fifty cents a ton in the handling of the coal will shortly be effected by the installation of a modern conveying system. Of course, the financial aspects of coal-handling machinery need to be carefully figured before a decision is made to install an equipment, and in newly designed plants it is desirable to avoid both hand labor and machinery in coal handling so far as the same results can be secured by gravity distribution of fuel.

UNNECESSARY RISKS SHOULD BE CONDEMNED.

Happily, deaths due to electric shock are very rare, and when they do occur they are likely to be caused by unavoidable accidents or carelessness on the part of the one who suffers. Every tendency toward carelessness on the part of workmen should be strongly condemned by those over them. In certain lines of electrical work it is often necessary for the man to be in a position where he can secure a shock, but conditions should never be such that momentary thoughtlessness puts him in great danger.

A breakdown in apparatus will sometimes present the alternative of effecting the repair without disconnecting it from the system or taking the risk involved in working on a machine which is charged. Whenever this risk is at all great no workman should be allowed to take it. One never knows what conditions exist in a damaged dynamo or transformer until the device has been more thoroughly examined than can be done while it is in operation, and although it may seem easy to effect a temporary repair in order to keep the device in service, this should not be attempted at the risk of the repair man. A case of this kind occurred recently in Denver. A young engineer attempted to repair a damaged transformer, preferring to take the risk rather than to disconnect the service even for a short time. He was brave enough to do so, even though others had refused, but his courage did not prevent him from being killed, a loss much more serious than a temporary interruption of service.

CIRCLES OF ELECTRICAL DEVELOPMENT.

It is always interesting, in tracing the progress of electrical development, to notice how certain methods and devices are invented, used and then discarded, to be reinvented or reapplied some years later. Each stage, of course, is due to some change in methods or construction, which makes the particular method or device either useful or unnecessary. A very interesting instance of this return to old devices is due to the necessity for better commutating methods in the modern high-speed generators.

Some fifteen years ago, after the high-speed engine had reached a high plane of development, demand was made for direct-connected generating units of large size, and generator speeds began to decline. The materials used in their construction were employed to better advantage, and with the lower speeds conditions for commutating were more favorable. For this reason, a revival of the earlier commutating auxiliaries, such as the auxiliary pole and the compensating coil, did not go far, although both of these solutions were proposed and experiments showed that they did give good results. The decrease in speed minimized the troubles; ten years before that time they had been largely eliminated by improvements in design. Now these aids have been again revived, to meet the condition imposed by steam turbine speeds. One wonders how long it will be before improvements in design or materials will again render these auxiliaries unnecessary.

Notes on Gas-Engine Practice.

With Special Reference to the Westinghouse Horizontal, Double-Acting Gas Engine.

THE particular type of large gas engine under consideration may be considered as the result of about ten years' actual development of various sizes and types at East Pittsburg. The gas engine has held its field against the steam turbine owing to inherent efficiency of the gas power system, and the long experience of the builders in steam-engine practice has been put to excellent use and embodied in the heavy-duty reciprocating gas engine. The present product of the East Pittsburg works may not, therefore, be considered an untried product, and this development period has witnessed its application to every known kind of fuel gas and to every kind of service for which reciprocating steam engines have been adopted.

During these ten years, 1,054 engines have been entered on the order books, this aggregating nearly 140,000 brake horse-power, or a little over 140 horse-power per unit. The plants equipped number 648, over one-third of which (225) are above 100 horse-power. Moreover, more than ninety per cent of this total is either in operation, erecting, or in process of shipment. At this date there were also stock orders booked sufficient to bring the total business recorded by this company up to over 162,000 brake horse-power.

In the list of various classes of service to which gas engines have been applied may be found some especially interesting exhibits. There are now in operation twenty-five-cycle, single-phase interurban railways, sixty-cycle central stations, twenty-five-cycle and forty-cycle industrial plants, all operating in electrical parallel. There are also many direct-current plants. For the above, both horizontal and vertical types have been installed. Among these may be mentioned the blast-furnace plants at Bessemer (Fig. 1) and Gary, Pa.; cement mills at Iola, Kan.; oil refineries at Philadelphia; gas compressors for long-distance transmission in the natural-gas field, factory pumping plants, irrigation and canal pumping, and quick-starting fire service, as at Philadelphia. Isolated plants, such as the United Gas Improvement Company, Philadelphia, represent a considerable portion of the plants installed, and in some cities, such as Pittsburg and Newark, these plants have branched out into block lighting when located in the vicinity of office buildings.

While the largest number of engines are running on natural gas, the largest plants use some form of manufactured gas, such as blast furnace, producer or coke oven. Within the past year very material progress has been made in the application of producer gas to all classes of service, and it is probably true that the future of gas power rests with the corresponding development of the producer. A number of successful types are now in operation, using both bituminous and non-bituminous fuels, including both the suction and the pressure types, the former for plants up to a few hundred horse-power and the latter for the larger plants.

At the end of March, 1908, there were 122 power plants equipped with Westinghouse producer gas engines, comprising 271 engines and aggregating 68,000 brake horse-power, or an average of 553 horse-power per plant. The engines averaged approximately 250 horse-power each, and all equipments contained in the above total were either in operation at that date or in course of erection. The largest producer plant, about 3,000 brake horse-power, operates the works of the Winchester Repeating Arms Company, New Haven, Ct. This plant runs on bituminous gas with the intermittent type of producer. Two other large installations are operating at Buenos Ayres, South America, and in the borough of Walthamstow, London, England, the former using Mond (bituminous) and the latter Dowson (anthracite) producers. At San Luis Potosi, Mexico, and at Hilburn and Depew, N. Y., are also large plants operating on bituminous gas with the Loomis-Pettibone intermittent type of producer, and at Richmond, Va., one using a simple continuous type Wood producer with mechanical tar extractor. Previous experience indicates that the most successful producer development will be along lines of continuous operation and the conversion of tar into fixed gas before leaving the producer.

The most convincing proof of the capacity of a properly designed horizontal gas engine to meet conditions of modern power service is its ability to make long, continuous runs. In the mills of the Iola Portland Cement Company the engines are normally in continuous operation, and the record of eleven months shows actual operation 93.2 per cent for the horizontals and ninety-seven per cent for the verticals; in other words, the total outages for engine inspection and repairs was but 1.32 per cent of the total elapsed time in the case of the horizontals and 1.6 per cent for the verticals. The total outages due to both plant and mill were as low as from five to ten hours in thirty days. There are also similar records from the operation of two 3,000-horse-power air-compressor engines. For four months out of the year these units operated about ninety-three per cent average of the possible running time—in some cases as high as ninety-eight and ninety-nine per cent. During all of this time the plant was under load. In other words, the total outages due to the engine alone have been as low as six to twelve hours during the month. This extraordinary operation has been made possible by the use of automatic lubrication and proper design throughout.

Contrary to the general impression, parallel operation at all but excessive frequencies has ceased to constitute a difficulty. Although spring couplings are used in the vertical-type, single-acting engine, they are unnecessary in the horizontal engine, except for special cases. Moreover, standard flywheels, used on Westinghouse gas engines, are but little heavier in pounds per kilowatt rating than steel wheels. Although a double or triple set of igniters is provided to insure positive ignition, the actual cyclical variation due to the impressed crank effort is but a fraction of that of the variation at present considered permissible in steam practice. In other words, a sufficient factor of safety in amplitude of cyclical variation is provided in Westinghouse engines to provide for the contingency arising in case of displacement of one complete set of igniters; *i. e.*, with the engine operating on "three legs." The governing system employed controls the mixture directly at the inlet to each cylinder; not at a distant point, and a speed regulation as low as two and one-half per cent with a change from no-load to full load may readily be obtained.

Recognizing the definiteness of the point of overload capacity, the rating of Westinghouse gas engine is placed ten per cent below the maximum load the engine will sustain for a considerable period. Thus, an engine rated at 500 horse-power could sustain 550 horse-power for long periods. It must not, however,

be assumed that this is the absolute limit of load, for the ratings have been chosen conservatively enough to provide for a certain range of fluctuation in the heat value of gas. Thus an engine designed for and rated on 125 British thermal units producer gas is normally capable of sustaining full load with gas as low as perhaps 100 British thermal units. For example, during the Norton test the gas ranged between 100 and 136 British thermal units, yet this engine, normally rated at 500 horse-power, sustained 600 horse-power during the test, or twenty per cent overload. Again, an engine of similar size at Richmond, operating twenty-four hours a day, except Sundays, has carried overloads of thirty-three per cent for short periods, or twenty per cent for three hours, and has averaged full load for an entire month. At this plant the gas is rich, which partly accounts for this high performance. With poor gas these good results would not have been obtainable. With ignition and mixture properly set, an electric-driven unit can be made to unload automatically at the point of maximum power, by decreasing the voltage. In fact, such equipment is actually in service for boosting the voltage on outlying sections of a distributing network.

Owing to the high efficiency of the four-stroke cycle gas engine, economy is largely independent of the size of the unit, so that a 200 or 300-horse-power engine is nearly as efficient in heat consumption as an engine of 1,000 horse-power or more. Both show a heat consumption of close to 10,000 British thermal units per brake horse-power-hour. And this efficiency is largely independent of the kind of gas used, due to the fact that leaner gases will stand higher compression—up to 200 pounds for furnace gas. An important result of this uniform efficiency is that very large units are unnecessary except in very extensive undertakings where smaller units would become too numerous. With the cost per horse-power also upon practically the same plane, this condition will be even more apparent.

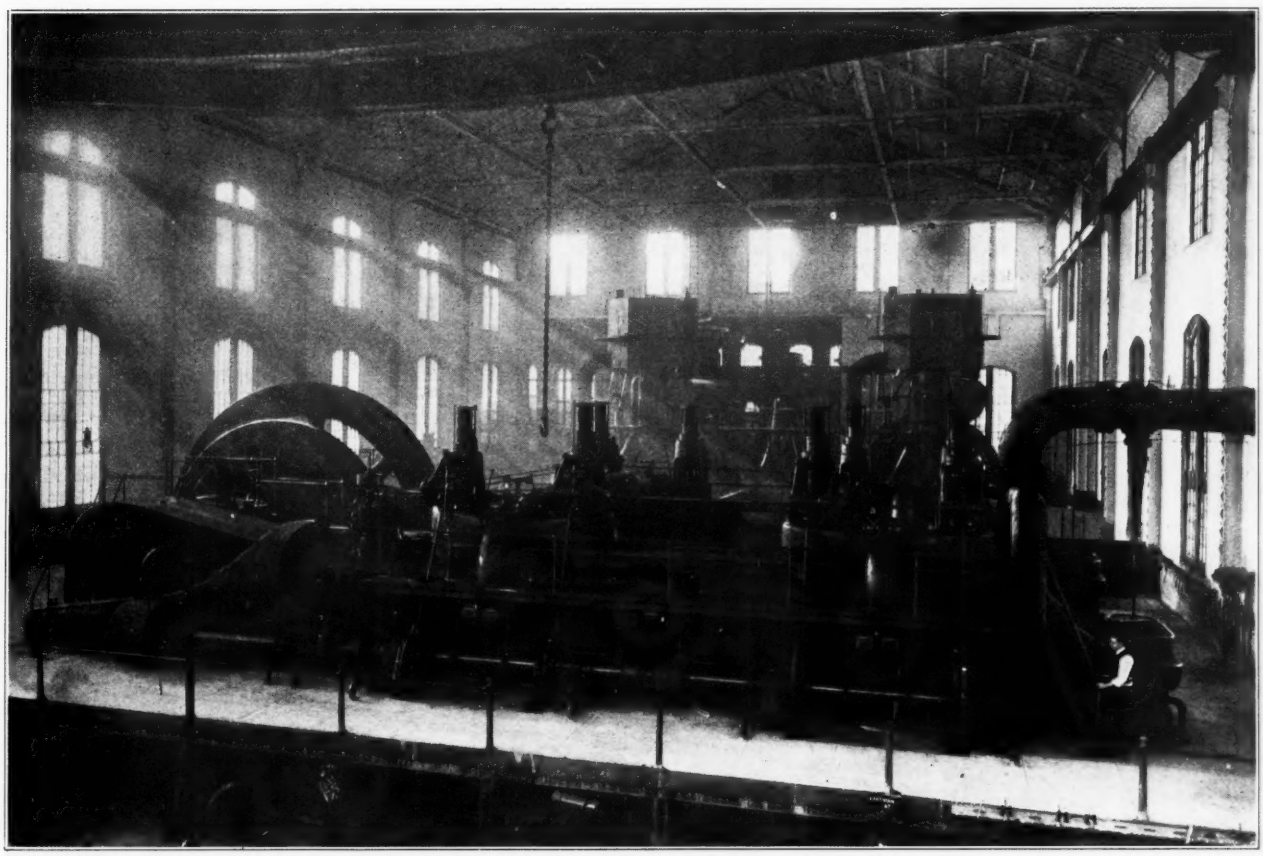


FIG. 1.—CARNEGIE BLOWING UNIT, BESSEMER, PA.

SPECIAL FEATURES OF THE WESTINGHOUSE HORIZONTAL GAS ENGINE.

In the adoption of the four-stroke cycle, the builders have proceeded in the belief that an engine of maximum simplicity and efficiency would result. The four-stroke cycle engine is self-contained. It does its own pump work and provides a sufficient length of time for the induction of mixture to reduce fluid velocities and resulting friction to a reasonable amount, and avoids entirely auxiliary pumping apparatus, the sole function of which is to overcome this friction of ports and passages within the allotted time. Furthermore, the four-stroke cycle avoids the necessity of attempting stratification, and utilizes a mixture always the most effective after once adjusted. This system does not involve uncertainty of combustion at light loads, if the purely throttling governing be employed, as is the case. The tandem cylinder arrangement is standard for all sizes of engines, whether single or double crank. The former gives two power strokes per revolution, the latter four power strokes per revolution with cranks at ninety degrees. This tandem arrangement, with reasonable size flywheels, easily yields a turning moment sufficiently uniform for all tandem work. A brief summary of some important points follows:

Access to exhaust valve from main floor. Two points of shaft alignment. Main bearing shell removable without disturbing shaft. Cylinder a symmetrical,

one-piece casting supported at ends only. Split jacket band provides access for cleaning. Removable water rings on lower jackets for cleaning. Cylinder accessible through valve openings without removing head.

Piston a symmetrical casting without internal ribs.

Piston port free from cylinder walls.

Two-part rods removable front and rear.

Floating metallic packing on rods.

Inlet, mixing and governor valves combined in a single mechanism.

One eccentric for both inlet and exhaust valves.

Air and gas mixed only at point of inlet.

Inlet and exhaust maximum distance apart, thus avoiding heating and contamination of mixture.

Individual governing at each inlet, with relay system relieving the governor of all work.

Governor driven direct from the main shaft.

Automatic safety stop for both overspeed and loss of cooling water.

Two or more independent sets of igniters, improving combustion and increasing power.

Igniter plug removable while engine is running.

Point of ignition variable while engine is running.

Double insulation of igniters; no platinum points; contact faces easily renewed.

Series water circulation for heads and pistons.

Independent water circuits for most important parts.

Open water funnels in each discharge.

Lubrication automatic and accurately timed.

Continuous gravity circulating system for engine oil.

Sight-feed oilers for important parts.

Starting automatic by means of compressed air.

Inoperative cylinders may be isolated while running.

Engine anchored forward; slides front and rear.

Although a solid concrete block extends the full length of the housing and some feet in front, a clear space exists between the piers, which permits access to the exhaust valves from the engine-room floor. In large engines, the exhaust valves may also be reached from a sub-gallery or basement. To inspect a cylinder inside, it is only necessary to remove the inlet valve to permit a man entering through the opening. One piston may be removed through each end of the engine without disturbing the other head or the engine alignment.

The main frame is of heavy box girder construction with internal ribs to withstand the transverse stresses arising from the side-crank construction standard in all Westinghouse engines. For this reason the box girder completely surrounds the crank pit, forming a rigid, rectangular structure anchored at the four corners. Access to the crosshead is obtained through windows in the housing. The centre and rear housings are approximately cylindrical structures, with the tops cut away to permit access to the centre and tail rod slippers. Where cut away, centre housings are reinforced by two removable steel struts designed to distribute the strain evenly to the cylinder bodies.

The cylinders of the small engines are symmetrical, one-piece castings, having an opening in the jacket walls, thus avoiding shrinkage in casting. Split jacket bands close the openings with joints made of flexible packing, which permits the cylinders to expand independently of the jackets. Suitable openings in the jacket walls permit cleaning the water spaces, which are completely accessible by removing the jacket band and water rings at the bottom surrounding each exhaust. The cylinders of the large engines are cast in halves to insure sound castings with the best metal where most needed—at the centre of the cylinders. The two halves are then fitted with a ground joint and arrow heads shrunk into the cylinder flanges.

The cylinder is supported at the ends

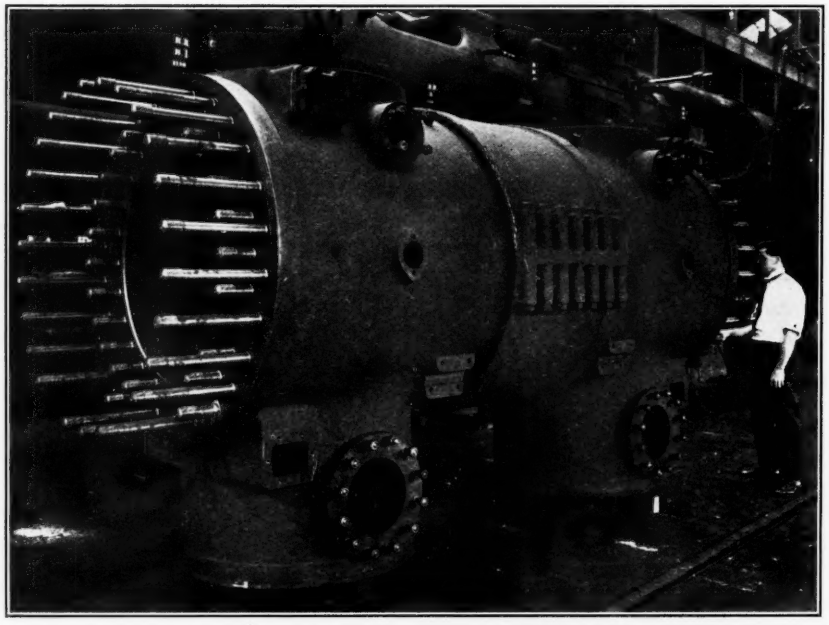


FIG 2.—BUILT-UP CYLINDER AND SPLIT JACKET.

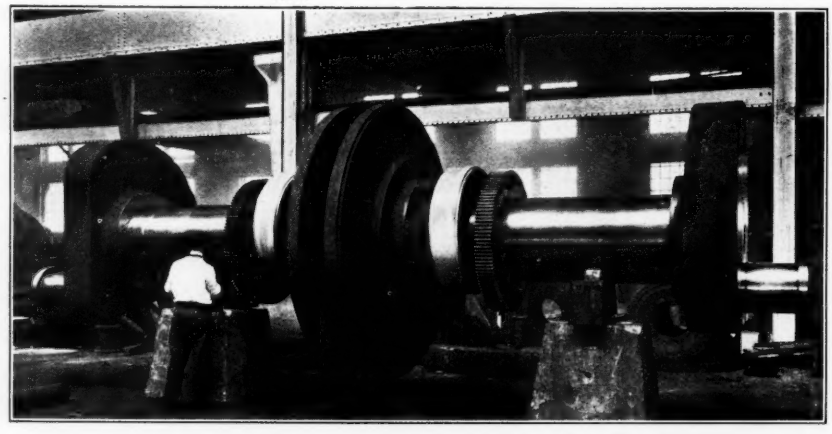


FIG. 3.—CRANK-SHAFT, WESTINGHOUSE GAS ENGINE.

only, and as the weight of the pistons and piston rods is carried by the cross-head, the cylinders are structurally simple cylindrical beams supporting their own dead weight at the ends. With the main frame securely anchored, cylinders are free to move longitudinally in machined ways supporting the housings.

Quick access to the cylinders may be had through the inlet valve opening. This is important, as it obviates the removal of a head. Another feature of the location of the valves in a vertical line at the centre of the cylinder is that heating and dilution of the incoming mixture are avoided —both of which tend to reduce the capacity of the engine. Moreover, the exhaust gases discharge straight downward without encountering any pockets for the accumulation of foreign matter. Compression spaces of volumes suitable for the various qualities of gas can also be readily obtained without changing the design of pistons or cylinders or the location of the valves.

As previously mentioned, all Westinghouse horizontal engines are of the side-crank construction, necessitating the alignment of but two bearings. The smaller shafts are solid forgings; the larger are bored hollow. Cranks, counterweights and crank-pins are cast in one piece, with the pin at the bottom of the mold to insure homogeneous metal. This design of crank is made necessary because of the relatively short stroke and large shaft diameter required. (Figs. 3 and 4.)

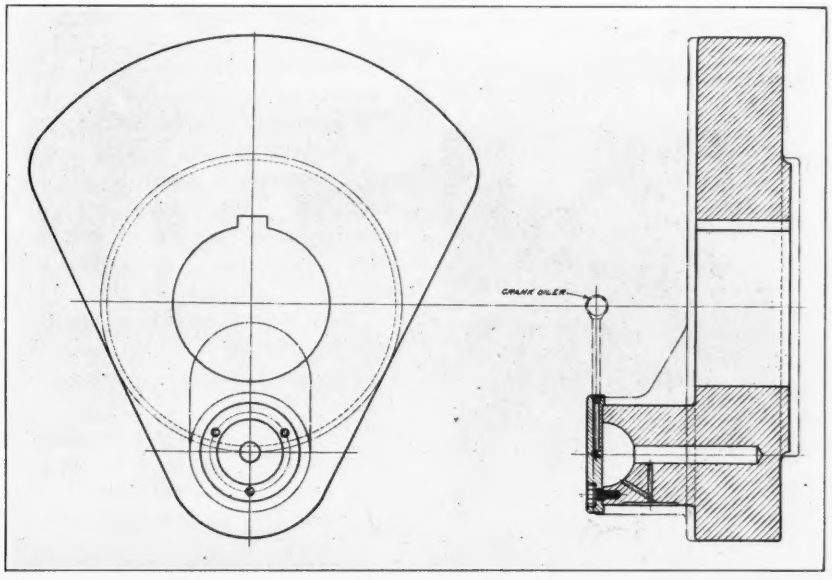


Fig 4.—Projection and Section of Crank.

On engines under 1,000 horse-power, a three-part bearing is used, and on larger sizes, a four-part bearing, with the usual quarter box and screw and wedge adjustment. For the smaller sizes, the bearing cap hooks over the uprights for reinforcement. In the large, through bolts are employed. Here the cover is simply a distance piece, or strut. Without disturbing alignment, the bearing shells may be rotated around the shaft and removed after relieved of the weight of the shaft. These bearings rest in spherical seats, and are consequently self-aligning.

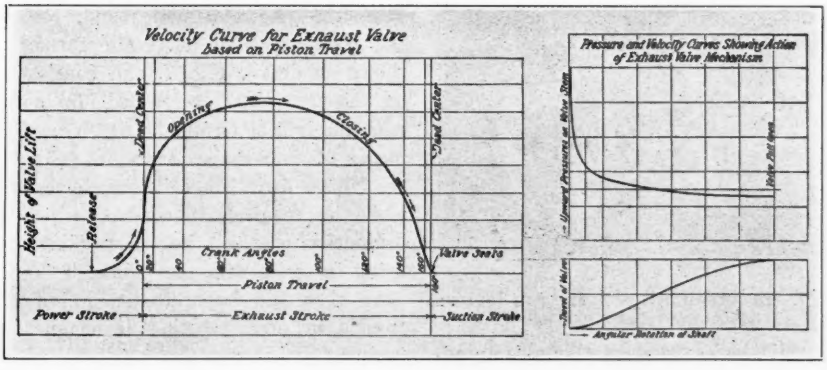


Fig. 5.—Curves Showing Effect of Operation of Inlet and Exhaust Valves.

The pistons are cast in one piece, are symmetrical in design, and avoid internal ribs or sharp corners, without the use of chaplets or other methods of core support. They are permanently mounted on the rod with a straight press fit and a retaining nut turned off flush with the piston after being set up.

Rods are made in two parts so as to permit removal through front and rear housing, which avoids the extra building clearance for a through rod. They are bored hollow for cooling water, except at the centre of the piston where the ducts connect. Front, centre and rear cross-heads support the entire weight of the pistons, which float free from and concentric with the cylinder walls, thus relieving the latter of wear. The rods are not cambered, but designed stiff enough to support the weight without undue deflection.

The pistons are kept tight by sectional rings with keepers and springs. For the rods, sectional metallic packing is employed, consisting of a number of segments mounted in series along the rod with two solid fire rings next to the cylinder. These segments are supported by springs to relieve the rods of their weight, so that they are practically floating. Adjacent segments break joints frequently, with the result that when properly lubricated, the packing is exceptionally tight, yet occasions no wear upon the rods.

Instead of a single governor valve controlling all inlets from a single point, the governing is accomplished directly at each inlet, the inlet valve performing the function of mixing and governing. Thus gas and air are mixed only at the point of entry to the cylinder, and in exact quantity required by the load—a condition of sensitive governing.

The inlet valve has two distinct motions, one due to the eccentric and the other to the rotation of a loose internal sleeve controlled by the governor and provided with ports registering with corresponding ports in the surrounding valve cage. The essential function of this rotating sleeve is that of a purely throttling governor, which opens or closes the respective ports according to the load. Hence the mixture itself remains unchanged at any load. Furthermore, the quantity of mixture which can be affected by a backfire is the comparatively small

volume contained within the inlet valve sleeve.

An excellent feature of this engine is that only one eccentric is employed to operate both inlet and exhaust valves, instead of independent cams or eccentrics. This eccentric motion is transmitted by pull rods to a rocking cam motion similar to that used in marine work. Inlet and exhaust are, of course, reversed to accomplish the valve openings at proper points in the cycle. This motion gives the very desirable maximum power at opening, followed by rapidly increasing lift as the valve opens, without bringing heavy thrusts upon the eccentric. The effect produced is shown in the accompanying curves, Fig. 5, one plotted to angular rotation of shaft and the other to piston travel.

In the lay shaft drive, "hunting tooth" gears are used, the intermediate lay shaft running at an odd number of revolutions per minute. This distributes the wear evenly over all the gear teeth, and hence greatly increases their life. The lay shaft carrying these eccentrics is driven from the main shaft by spur and bevel gear in place of the usual spiral gearing. This is designed to avoid the back lash which eventually develops with spiral gearing, due to the variable torque encountered. With fixed eccentrics and no lost motion, it is evident that no opportunity exists for change of adjustment of valves except from wear of the rolling cams, which is obviated by the use of generous contact areas well lubricated.

Hollow water-cooled exhaust valves of either cast iron or steel are used in all sizes, or a combination valve with cast-iron head and steel stem. Inside the bore a small tube rises to the head of the valve, constituting an overflow pipe. Cold water ascends through the outer annulus. The internal pipe not only prevents air pockets being formed, but also insures that the valve never becomes dry. Stems are lubricated about the middle of the bushing. To remove the valves it is only necessary to drop out the entire cage with the assistance of a rope swing.

By means of an oil-pressure relay system the governor or regulator is entirely relieved of the actual work of moving the heavy valves. Fig. 6 shows the location of the regulator and relay, driven direct from the engine shaft and connected by means of reach rods to the various inlet valves. The regulator itself is of a purely centrifugal type, of European design—the Hartung or the Jahns. Each involves straight-line motion for the governing weights and is fitted with an oil dashpot to prevent hunting. By driving the regulator directly from the main shaft, the effect of variable torque in a lay-shaft drive is avoided. Oil pressure for the relay is supplied at about sixty pounds' pressure by a small pump (either of the rotary or the piston type) driven from the engine lay shaft.

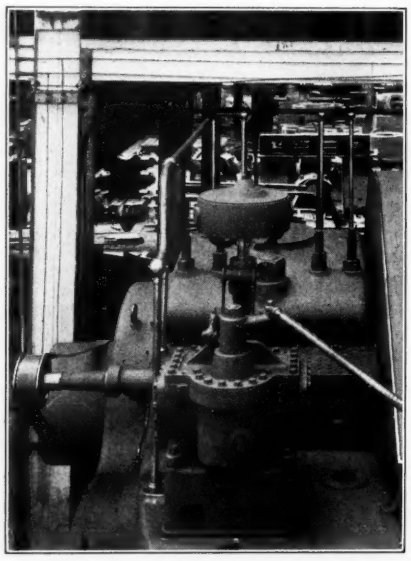


FIG. 6.—REGULATOR AND RELAY.

In the event of a possible disablement of the governor, a safety device interposes and shuts down the engine by cutting off the ignition. This stop consists simply of a spring-balanced plunger in the rim of the flywheel which, emerging through the actual centrifugal force at a predetermined speed, trips a pawl and opens a switch in the igniter circuit. Combined

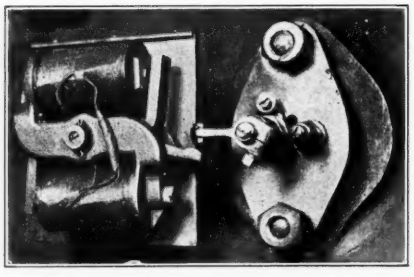


FIG. 7.—ELECTROMAGNETIC TRIP FOR IGNITER SYSTEM.

with this device, in some plants, is an additional safety stop to open the same igniter switch should the water supply to the jackets fail. This operation results from the movement of a loaded diaphragm under pressure of the cylinder water supply.

Make-and-break ignition has been adopted to the exclusion of all other systems, after much experimenting, as the most practical for average conditions. Jump-spark ignition proved satisfactory on rich gas, but showed erratic results with the high compressions used in blast-furnace gas practice. Platinum points formerly used are now entirely done away with, and cast iron or a special bronze is employed for the moving contact, working against a fixed steel terminal. High voltage and low current, furnished by a small motor-generator, give the desired security of action and long life. Both sides of the igniter circuit are thoroughly insulated by mica washers, thereby making a double ground necessary to put an igniter out of commission. Vent holes are drilled through the igniter cap to permit the escape of any gases or vapors which would otherwise be condemned inside. In the event of a serious ground, an igniter immediately insulates itself by the blowing of a fuse, one of which is inserted in each independent circuit.

Provision has been made for removing igniters while the engine is in operation, thus meeting an insistent demand. This is accomplished by shutting off gas from the cylinder and blocking open the exhaust valve, for which a lug or eccentric is provided. This relieves the compression.

An important point is the provision of two or more igniters for each combustion chamber; in the larger sizes, three igniters located at corners of an equilateral triangle. The results of using more than one igniter are: more rapid and perfect combustion and an increase in mean effective pressure of nearly four per cent for the second igniter; this is irrespective of the increased security of ignition. Two types of gears are in use for operating igniters: first, the electromagnetic, and, second, the mechanical cut-off. The former is shown in detail, Fig. 7, and consists of an electromagnet connected in series with the igniter terminals, which trips by means of an S-shaped armature engaging the igniter lug. The coils themselves furnish the required inductance, which is ordinarily provided by spark-coils, and, being in series with the points, it is evident that the apparatus will indicate trouble at once, whether in magnet or igniter. This constitutes a tell-tale which in the mechanical system must be provided separately in the form of a small board panel carrying choke-coils fitted with iron sounders which trip in succession as the igniter contacts are made. An essential advantage of this system is that any number of igniters may be operated with facility and without complex mechanism, and the contactor provides ready means for advancing or retarding ignition

while the engine is running, by simply rotating the case to which the contact points are attached.

The mechanical device carries the usual knock-off cams geared to the lay shaft through an adjustable drive designed to advance or retard the ignition in the same manner as in the magnetic system for meeting the requirements of gases of varying richness.

Recognizing engine lubrication as a vital necessity, the builders have relieved the operator entirely of the work by automatic lubrication. For the cylinders, force-feed lubricators are employed, as shown herewith. As is most important, the oil is accurately timed so as to reach the piston just at the close of the power stroke when covering the oil ports. Thus during two working strokes at low temperature the oil is evenly distributed over the entire surface, insuring good lubrication with a minimum supply of oil. In a number of 500-horse-power plants, cylinder oil consumption is as low as from three to five gallons a week, ten-hour day. This timing may be accurately adjusted by means of four small eccentrics in Fig. 8. These lubricators serve cylinders, packing glands and exhaust-valve stems.

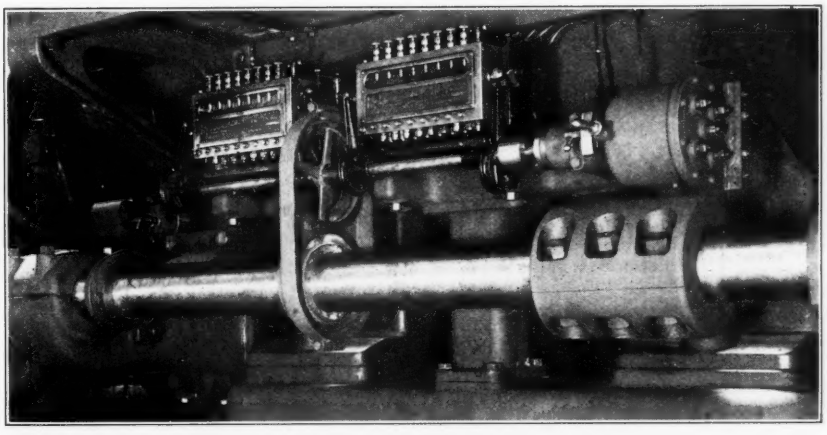


FIG. 8.—FORCE-FEED LUBRICATORS DRIVEN FROM LAY SHAFT.

Engine oil is served by a gravity system, including pump, filter and elevated reservoir with individual sight-feeds, all controlled by a single valve, so that individual adjustments, once set, need not be changed. Here again, the oil consumption has been reduced to a minimum—that due to evaporation, leakage and renewals, at the same time having sufficient available for thoroughly flushing all parts.

Particular attention has been given to reducing the quantity of cooling water required for the engine. For this purpose a series system has been employed to some extent. Individual circuits, provided with open discharge, make it possible to follow closely the condition of each working part; thus, each cylinder, piston and exhaust valve have separate discharges. As pistons and heads have about the same exposed surface these parts are connected in series so as to secure a fairly uniform average temperature. Jacket spaces found in the cylinder are purposely of ample dimension to afford opportunity for occasional cleaning out of the sediment; if necessary by the renewal of the split jacket band; otherwise through hand holes and water ring at the base. Water enters the piston through telescopic connections located at the centre crosshead and discharges front and rear into chambers cored out of the front and rear housing. The velocity through rods and pistons is high enough to prevent the deposit of sediment, a practice also adopted for the exhaust valves and other restricted areas. A water pressure of twenty-five pounds is all that is required for supplying all parts, and in some plants with exceptionally pure water, a twenty-five-foot static head is sufficient.

As in smaller sizes, the horizontal engines are started by compressed air and automatically through individual cams and poppet valves located along the lay shaft opposite each combustion chamber. With ignition on, the engine starts itself after opening the compressed-air and gas valves. As each cylinder picks up its ignition (after one or two revolutions) the compressed-air supply automatically ceases by means of a check-valve held to its seat by the combustion pressure. But the air continues until combustion has started in all four chambers, when it is shot off at the throttle. Then the air-valves drop out of engagement by their own weight. How effective this system is in practice is best illustrated by the results regularly obtained at the Philadelphia high-pressure pumping station, where pressure is on the mains in less than one minute from the time of signal.

As the pressure of gas supplied to the engine is always subject to considerable variation, it is necessary to provide an automatic regulator in the supply line to maintain at the inlet valves the proper mixture. This mixture is ordinarily set by the operator by means of two butterfly dampers in the air and gas-supply pipes leading to each inlet. The main gas regulator employed on Westinghouse engines consists simply of a butterfly disc valve inserted in the supply line, the position of which is controlled by a small gasometer connecting with the main on the engine side. Thus the movement of the gasometer and the butterfly follows instantly upon the varying demand for gas by the engine. In some cases it is also desirable to install a cast-iron or steel receiving tank in the basement of the engine room to dampen the fluctuations in pressure resulting from the intermittent demand of the engine cylinders.

Telephone and Telegraph Service in Colombia.

A United States consular report announces that the Department of Posts and Telegraphs of Colombia has extended the contract made in 1906 with Francisco J. Fernandez for the construction, repair and operation of the federal telegraph and telephone lines, for a period of five years, beginning with January 1, 1908. According to the agreement, the contractor must maintain the present lines in good repair and furnish material and apparatus for future construction, according to the terms laid down. He must also introduce the German type of Hughes instrument and establish a school for instructing operators in the use of this instrument, and also in the operation of wireless telegraph apparatus. At the end of five years the entire system is to be turned over to the government in good condition.

Wireless Telegraphy in Peru.

It is announced in *El Peruano,* the official publication of the Peruvian Government, that the sum of $37,500 has been appropriated, in accordance with a recent law of the National Congress, for establishing a wireless telegraph line from the region known as "montaña" to the city of Iquitos.

Subcommittees of the Electrical Committee of the Underwriters' National Electric Association.

The following have been appointed on the subcommittees of the electrical committee of the Underwriters' National Electric Association, to consider various subjects during 1908. Any correspondence with these committees should be addressed to the chairmen:

Committee on Signs and Outline Wiring—J. C. Forsyth, chairman, 32 Nassau street, New York, N. Y.; J. E. Cole, 11 Wareham street, Boston, Mass.; W. D. Carroll, city electrician, Chicago, Ill.; J. R. Strong, 35 South William street, New York, N. Y.; Arthur Lewis, Wilkes-Barre, Pa.

Committee on Rule 64 Signaling Systems—F. E. Cabot, chairman, 55 Kilby street, Boston, Mass.; Ralph Sweetland, 55 Kilby street, Boston, Mass.; E. A. Fitzgerald, box 298, Syracuse, N. Y.; C. H. Hill, 316 Walnut street, Philadelphia, Pa.; F. W. Jones, 253 Broadway, New York, N. Y.; C. C. Johnson, 195 Broadway, New York, N. Y.; H. S. Warren, 15 Dey street, New York, N. Y.

Committee on Transformers—C. H. Hill, chairman, 316 Walnut street, Philadelphia, Pa.; H. R. Sargent, General Electric Company, Schenectady, N. Y.; C. E. Skinner, Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.; G. S. Lawler, 31 Milk street, Boston, Mass.; Dana Pierce, 382 Ohio street, Chicago, Ill.

Committee on Telephone Switchboard Lighting—R. P. Strong, chairman, 809 Hibernia Building, New Orleans, La.; W. H. McDonald, 703 Wilder Building, Rochester, N. Y.; W. S. Boyd, 125 Monroe street, Chicago, Ill.

Committee on Electric Cranes—G. S. Lawler, chairman, 31 Milk street, Boston, Mass.; J. G. Emery, Jr., Shaw Electric Crane Company, Muskegon, Mich.; A. G. Wilbor, 5 Haynes street, Hartford, Ct.

Committee on Rule 2a—G. E. Bruen, chairman, 135 William street, New York, N. Y.; Arthur Williams, 55 Duane street, New York, N. Y.; F. A. C. Perrine, 60 Wall street, New York, N. Y.

Committee on Switches and Cutouts—H. O. Lacount, chairman, 31 Milk street, Boston, Mass.; J. E. Cole, 11 Wareham street, Boston, Mass.; Dana Pierce, 382 Ohio street, Chicago, Ill.; Ralph Sweetland, 55 Kilby street, Boston, Mass.; F. E. Cabot, 55 Kilby street, Boston, Mass.

Committee on Variable-Speed Motors—H. O. Lacount, chairman, 31 Milk Street, Boston, Mass.; C. E. Skinner, Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.; H. R. Sargent, General Electric Company, Schenectady, N. Y.

Committee on Approval of Laboratory Reports—George E. Bruen, chairman, 135 William street New York, N. Y.; Dana Pierce, 382 Ohio street, Chicago, Ill.; J. C. Forsyth, 32 Nassau street, New York, N. Y.

Committee on Fixture Wire—Dana Pierce, chairman, 382 Ohio street, Chicago, Ill.; E. A. Fitzgerald, Box 298, Syracuse, N. Y.; W. S. Boyd, 125 Monroe street, Chicago, Ill.

Committee on Auto-Starters—C. H. Hill, chairman, 316 Walnut street, Philadelphia, Pa.; Dana Pierce, 382 Ohio street, Chicago, Ill.; F. E. Cabot, 55 Kilby street, Boston, Mass.

Committee on Re-Codification of Code—C. M. Goddard, chairman, 55 Kilby street, Boston, Mass.; H. O. Lacount, 31 Milk street, Boston, Mass.; J. E. Cole, 11 Wareham street, Boston, Mass.; W. H. Blood, Jr., 147 Milk street, Boston, Mass.; E. McCleary, Stevens Building, Detroit, Mich.

Committee on Details of Switchboards—Ralph Sweetland, 55 Kilby street, Boston, Mass.; H. O. Lacount, 31 Milk street, Boston, Mass.; C. E. Skinner, Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.; H. R. Sargent, General Electric Company, Schenectady, N. Y.; W. Devereux, Bullitt Building, Philadelphia, Pa.

Committee on Cutout Cabinets—A. R. Small, chairman, 382 Ohio street, Chicago, Ill.; W. S. Boyd, 125 Monroe street, Chicago, Ill.; R. A. Smith, City Electrician, Norfolk, Va.; A. F. Hills, Crouse-Hinds Company, Syracuse, N. Y.; J. R. Strong, 35 South William street, New York, N. Y.

Committee on Rule 13a—C. M. Goddard, chairman, 55 Kilby street, Boston, Mass.; F. E. Cabot, 55 Kilby street, Boston, Mass.; E. V. French, 31 Milk street, Boston, Mass.

Committee on Specifications for Stage and Elevator Cables—J. E. Cole, chairman, 11 Wareham street, Boston, Mass.; H. C. Harris, Outlook Building, Columbus, Ohio; W. D. Carroll, City Electrician, Chicago, Ill.

Committee on Rheostats—George E. Bruen, chairman, 135 William street, New York, N. Y.; J. C. Forsyth, 32 Nassau street, New York, N. Y.; A. R. Small, 382 Ohio street, Chicago, Ill.

Committee on Induction Motors as to Wires and Fusing—F. E. Cabot, chairman, 55 Kilby street, Boston, Mass.; H. O. Lacount, 31 Milk street, Boston, Mass.; H. S. Wynkoop, Room 33-A, Municipal Building, Brooklyn, N. Y.; C. E. Skinner, Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.; H. R. Sargent, General Electric Company, Schenectady, N. Y.

Committee on Circuit-Breakers—A. M. Schoen, chairman, 339 Equitable Building, Atlanta, Ga.; Dana Pierce, 382 Ohio street, Chicago, Ill.; H. Ward Leonard, Bronxville, N. Y.; A. W. Berresford, Cutler-Hammer Manufacturing Company, Milwaukee, Wis.; T. S. Perkins, Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.

Committee on Mercury-Vapor Lamps—J. C. Forsyth, chairman, 32 Nassau street, New York, N. Y.; E. A. Fitzgerald, Box 298, Syracuse, N. Y.; William McDevitt, 131 South Fourth street, Philadelphia, Pa.

Committee on Street Railway Property—Ralph Sweetland, chairman, 55 Kilby street, Boston, Mass.; William McDevitt, 131 South Fourth street, Philadelphia, Pa.; B. E. Loomis, 19 Liberty street, New York, N. Y.; O. B. Johnson, 55 Kilby street, Boston, Mass.; H. F. Strickland, 27 East Wellington street, Toronto, Canada.

Committee on Theatre Wiring—J. E. Cole, chairman, 11 Wareham street, Boston, Mass.; H. C. Harris, Outlook Building, Columbus, Ohio; W. D. Carroll, City Electrician, Chicago, Ill.

New York State Legislation.

During the last few days of the New York state legislative session for 1908, which adjourned on April 23, several bills of interest and importance to public-service corporations came up.

Senator Page's Public Service Commission amendments, extending the jurisdiction of the commissions to telephone and telegraph companies, ferries and stage lines, was passed by the senate and referred to the assembly for concurrence. The Assembly Rules Committee, to which it was referred, however, failed to report it for passage.

The senate passed the Coney Island five-cent fare bill, and as this had already passed the assembly several weeks ago, the measure will go to the governor. It is expected that this bill will be vetoed on the same ground that the two-cents-a-mile bill was vetoed last year.

The senate failed to pass Senator McManus' bill compelling street railroad corporations in New York city to issue return tickets to workingmen on the payment of one fare.

Governor Hughes vetoed Senator Bryce's bill compelling the installation of water-closets on interurban cars seating forty-five passengers and on roads not less than forty-five miles in length. The governor is of the opinion that this is a matter with which the Public Service Commission can deal.

One of the most important measures passed was the amended Travis-Robinson rapid transit act and the Travis-Lee constitutional amendment exempting subway bonds and other self-sustaining bonds from the debt limit of the city. The first of these acts repeals the Elsberg law and offers much more liberal terms to contractors, and will, it is believed, prove successful in inducing the investment of private capital in large amounts in city subways.

The Omaha Electrical Show.

The Nebraska Electrical Trades Association, of Omaha, Neb., will open its first annual show in the Omaha Auditorium, on May 4, to continue one week. The management of the show has succeeded in securing a large number of excellent exhibits, and every indication points to a great success. The Auditorium, which is located near the heart of the city, will be beautifully illuminated and decorated by means of an elaborate and artistic lighting scheme. All of the local electrical houses in Omaha and Council Bluffs will be represented at the show, and among the more prominent electrical manufacturers, the following may be mentioned: General Electric Company, Westinghouse Electric and Manufacturing Company, Crouse-Hinds Company, Central Telephone and Electric Company, Fort Wayne Electric Works, Adams-Bagnall Electric Company, Benjamin Electric Manufacturing Company, Buckeye Electric Company, Economical Electric Lamp Company, Independent Arm and Pin Company, Nungesser Electric Battery Company, Blake Signal and Manufacturing Company, the Batteries Supply Company, Crescent Insulated Wire and Cable Company, Duplex Metals Company, the Federal Electric Company, Mathias Klein & Sons, National Carbon Company, Sprague Electric Company, Handel & Company, Ceramite Manufacturing Company, John A. Roebling's Sons Company, H. W. Johns-Manville Company, Nernst Lamp Company, I. L. Ide Company, Crown Electric Washer Company.

SHORT TALKS ON CENTRAL STATION ADVERTISING.

BY J. O. LITTLE.

THE IMPORTANCE OF TALKING PRICE.

One of the first questions asked by the reader of an advertisement aimed directly at the consumer is, What is the thing advertised going to cost? The busy man, the man who has the purchasing power, always wants information on this point and he doesn't want to have to beat around the bush to get it. With this piece of information at hand, it doesn't take him long to decide whether or not he wants to talk business; without it, he too frequently lets the matter drop right there. Many otherwise strong advertisements lose force just because they fail to give prices.

If the article is one with whose range of prices everybody is tolerably familiar, as, for instance, a man's hat, it is not so important that the price should be given. Still, if you have an especially good hat at three dollars, it's better to say the price is three dollars than to let some guess that it's two and others five.

If, on the other hand, it is something whose range of prices is unfamiliar to the majority of people, the line that gives the price is the most valuable in the whole advertisement. Take electrical power apparatus and central station service. In the case of the larger applications it is difficult to get down to exact figures, and the figures for one case would not suit another; but when it comes to small motors of definite application, the cost of the service, including original cost and up-keep of the apparatus, should be made a prominent feature of the advertising. A good plan is to talk economy in connection with larger applications and to demonstrate it in actual figures when dealing with smaller and popular applications.

Few people have any idea of what some application whose description reads well is going to cost to install, to maintain or to feed. Most people are from Missouri, or thereabouts, when it comes to the cost of new ways of doing things, and they want to be shown.

It's an easy matter for the central station to show people economy, either direct or indirect. It is so easy that every advertisement that goes out should dwell upon it. A bare statement of price sometimes scares people off, but if you take the pains to show them that a given expenditure means increased profits or increased pleasure they become interested. People are lazy when it comes to analyzing your proposition; you can't depend upon them. You must give it to them already analyzed and predigested.

To say that a motor for a certain application costs $15 or $100 is stating it too bluntly. It leaves the reader too much to imagine. He has to figure out what returns he is going to get and how the investment is going to pay him. This is what he doesn't want to do, and you don't want him to do it either. You can figure it better than he can and you should do it.

A good way to express cost is on the instalment-store plan, a dollar down and two dollars a month. Many people like to buy this way, else the instalment business would not be so popular. All people, even those who would not think of anything but a cash transaction, like to figure this way, because it justifies the expenditure.

The furniture for a room at a dollar down and two dollars a month may be worn out before the final two dollars is paid. Good buyers do not want to know how much time they can have in which to pay for a thing, but how long a period of usefulness the price they pay represents. They want to know how much the thing is going to cost per month or per year to own, keep in order and operate.

Take the case of the fan motor. Instead of pricing it in the advertisement at, say, fifteen dollars, divide the price by the number of years it should run with proper attention and say it costs so much per year to own and so much to feed. Many a man who would pass by a fifteen-dollar article will not hesitate to invest when he discovers that the cost per year is several times less.

A sewing-machine motor, which costs only a couple of dollars a year to own and no more than a standard lamp to operate, should appeal to every man who has a home where sewing is done, and it is the cost expressed in this manner that impresses him first. This is one of the best applications to advertise, as it is one of the easiest for the central station to handle.

It takes people a long time to become familiar with the cost of current for different operations, and every advertisement should say something about it. A good plan is to take the sixteen-candle-power lamp as a basis and to say a given application costs no more for current than a standard lamp, or two or three standard lamps, as the case may be.

A glance at the department-store advertisements would lead one to believe that we are a nation of bargain-hunters. This is true in a sense, for we are all seeking economy, but the best buyers are usually more impressed by an advertisement that justifies a regular price than one that offers a $20 article for $10. It may not pay in the department store, but it does in general business, to defend and explain a just price rather than to cut it in two.

People are so little acquainted with the apparatus that the central station has to offer that they are no judges of price. They must be educated. They must be shown wherein a given price for an application and for current to feed it means saving of labor, time, annoyance and fire risk, and an improvement in general conditions that not only warrants it, but that means actual economy.

Some applications have been developed to the point where their economy and convenience make an argument that can not be refuted, and they are the ones that should be pushed in advertising. Their cost, when properly expressed, means money saved, and no advertisement should fail to force it upon the reader's attention.

New York Central Bond Issue.

The Public Service Commission for the Second District (up-state), state of New York, granted, on April 20, the application of the New York Central & Hudson River Railroad Company to issue $4,000,000 three and one-half per cent and $20,000,000 four per cent bonds. A. H. Harris, general counsel, and other New York Central officers explained that the company would issue the bonds as rapidly as the financial situation would permit and that the proceeds would go for improvements along the company's lines. There was no opposition to the company's application.

The schedules submitted showed that of the $93,000,000 of improvements authorized up to December, 1907, there had been expended $40,000,000. The authorization of bonds at this time is to provide for obligations incurred for improvements in the past, amounting to $7,120,000, expenditures this year of $8,547,152.97 and the balance for future improvements.

The improvements to be made during the year are: Motive power facilities, $747,530; signal improvements, $462,849; Eastern division, $324,732; Mohawk division, $269,174; Western division, $1,395,213; Rome, Watertown & Ogdensburg division, $54,734; Pennsylvania division, $50,000; River division, $282,833; Electric division, $18,769; miscellaneous, $9,175; electric zone construction, $3,432,500; additional facilities needed for motive power and car repairs, $1,299,500.

DEPRECIATION IN ELECTRIC RAILWAY ACCOUNTING.[1]

BY DANIEL ROYSE, ASSISTANT EDITOR-IN-CHIEF, THE RAILWAY AGE.

Electric railways comprise an important part of the transportation industry of the country and are founded upon an enduring need. Therefore their securities should be among the most desirable of investments, considering both safety and income, but even in the largest centres of population, where the need of transportation is greatest and large earnings most certain, electric railway securities have in the past proved to be most precarious—not only as to earnings, but as to safety of capital—to illustrate which it is only necessary to refer to recent history in Chicago and New York.

This anomalous condition exists because for years the electric railway was on a promotion basis and was made to yield big returns to a few—it being made to appear that these returns came out of the earnings, when really they were in large part improper diversions of the capital of many innocent investors in both stocks and bonds. The practice of dissipating capital in the guise of dividends was possible because the matter of providing for the renewal of the physical property was ignored until the need of renewal was imminent, and then the simple device of a reorganization or a sale or lease to a new company afforded opportunity for charging the cost of rebuilding to capital account. In some cases corporation was thus piled upon corporation until the outstanding capital obligations amounted to ten or more times the annual gross earnings—in practice, apparently, the only limit was the capacity of the bond market to assimilate securities.

The fact that "Depreciation" is one of the subjects on the programme for this meeting of the Iowa Street and Interurban Railway Association is an indication not only that the members of the association recognize that depreciation of the physical property of electric railways does occur, but also that they wish to consider the extent to which it is desirable to make present provision for the demand which the future will bring.

Heretofore recognition of depreciation and of the accrued liability resulting from it seldom has been given except when trying to convince the tax assessor that the property was not nearly as valuable as the reports of net earnings seemed to indicate, or when endeavoring to demonstrate that the books of some plant owned or operated by a municipality were not properly kept. Now, however, principally because of the activity of the Interstate Commerce Commission and of the state railway commissions, which promise to co-operate with the national body, conditions are changed, and it is the part of wisdom, and of expediency as well, to meet the new conditions squarely and work in harmony with these regulating bodies.

The most serious effect of the mistaken theory heretofore so generally followed by electric railways is not the deceiving of investors, though in some cases the result to them has been sufficiently disastrous, but the misinforming of the public. Taught to believe that electric railways are cheap to operate and yield large returns to the owners, the public naturally has demanded that fares be reduced, that compensation for franchise grants be paid, that more extended transfer privileges be given, that the streets be paved, cleaned and lighted by the railways operating in them, etc. Moreover, it is believed that the growth of the idea that franchise grants should be strictly limited to a short term is for the most part due to this same misapprehension on the part of the public for which the railways are directly responsible.

In considering what present provision for future demands it is desirable or necessary to make, railways should be classified according to the length of time their franchise grants run. Depreciation applies to all railways, but plans for the amortization or retirement of the capital need be made only by those companies having short-term franchises.

Depreciation is that deterioration of the physical property which is not made good by current repairs. For example, a car, though kept in the best of repair, eventually will have to be taken out of service and replaced. If the term of service be twenty years it is evident that the car each year has depreciated in value to the extent of five per cent of the difference between its original cost and its value as scrap. Assuming a scrap value of twenty per cent of the original cost, there will be a depreciation of four per cent per annum on the car. If no provision has been made for this current depreciation, when the time comes for replacing the car it will be necessary to charge the eighty per cent of the cost of the old car to operating expenses if the capital is to remain unimpaired.

This in general has for many years been the practice of the steam railways, and is that prescribed in the "Standard Classification of Operating Expenses," adopted in 1908 by the Street Railway Accountants' Association. There is, however, much reason to believe that electric railways have too often charged renewals to "Construction" or "Reconstruction," instead of to operating expenses under the head of "Maintenance," as the standard requires.

But even if the injunction to include in maintenance "all expenditures for repairs and renewals" be strictly observed, there will be a gradual reduction in the value of the physical property subject to depreciation that will finally amount to between forty and fifty per cent of the original cost of that property. To illustrate: Railways develop gradually and their equipment is acquired from time to time as the need arises. Now, take twenty cars, purchased one each year, the oldest having been in service nineteen and one-half years, another eighteen and one-half years, and so on down to the newest, which is one-half year old. The life of cars being taken at twenty years, the total car-years, and so on down to the newest, which cars is 200, or an average of ten years per car. With salvage at twenty per cent of the cost the average depreciation of the cars is $\frac{1}{2}$ (100 — 20) = 40 per cent of the cost.

The same reasoning applied to other classes of equipment will give similar results, varying a little according as the scrap value is greater or less than twenty per cent. When a group of units, such as the cars in the example cited, varying in age by equal increments, is considered the life assumed does not affect the average depreciation, it being always one-half of the total life if the computation be made midway between the regular renewal dates. Hence the conclusion that when proper renewals are made the normal value for service of the physical property of a railway after a sufficient period of operation is only from fifty to sixty per cent of its original cost.

In Accounting Series Circular No. 20, dated January 10, 1908, Professor Henry C. Adams, in charge of statistics and accounts for the Interstate Commerce Commission, submitted tentative classifications for the operating expense accounts of electric railways engaged in interstate commerce, which classifications contain provisions for depreciation accounts as follows:

A. Under the head of "Depreciation

[1] A paper presented at the meeting of the Iowa Street and Interurban Railway Association, Des Moines, Ia., April 23 and 24, 1908.

Estimate — Revenue Equipment," in "Maintenance of Equipment," there are provided eight accounts for cars and locomotives, and under "Depreciation Estimate—Service Equipment," in "Maintenance of Way and Structures," three accounts. Each of these eleven accounts is designated "Depreciation Estimate" and is subdivided into two subaccounts designated as "Estimate" and "Renewals," respectively. The instructions as to what are included in the subaccounts, taking "Passenger Cars" as an example, read as follows:

"a-1. Passenger Cars—Estimate.

"This account includes a monthly charge of one-twelfth (1/12) of .... per cent per annum of the original cost (estimated, if not known) of passenger cars, to provide a fund for replacement when retired.

"NOTE—Where, in the opinion of the carrier company, depreciation can be more accurately estimated by basing the estimate upon the service rendered by the property, such method of estimate may be permitted, in case the carrier company first files with the ..... commission a statement of the rule or principle upon which it will base its estimates of depreciation, subject to disapproval by the commission.

"a-2. Passenger Cars—Renewals.

"This account includes the original cost (estimated, if not known) of all passenger cars condemned, destroyed or sold, less:

"Amount previously charged for depreciation up to date of retirement; plus

"Scrap value of salvage or the amount received from sale of passenger cars retired.

"NOTE A—Passenger cars permanently retired from service, but held, pending disposition, should be written out of service through this account, and carried in an appropriate material account at a nominal valuation or at actual scrap value, if determinable.

"NOTE B—The appropriate charge to this account, in respect to equipment in service on (a fixed date, as, July 1, 1908), will be determined by deducting from its depreciated value on that date the amount charged for depreciation accruing subsequently to (June 30, 1908), up to the date of retirement, and the scrap value of salvage or the amount received from sale of such equipment retired. The depreciation accruing before (a fixed date, as, July 1, 1908), must not be charged to the operating expenses of any part of the period subsequent to (June 30, 1908). The purpose of the instructions in this note is to prevent any charge against Renewals Account for depreciation accruing previously to the setting up of regular depreciation charges under this classification, and, inasmuch as such previously accrued depreciation is not an item of current operating expenses, it should be adjusted by appropriate entries in the general books."

B. Under the head of "Depreciation Estimate—Maintenance of Shop and Power Apparatus," in "Maintenance of Equipment," there are provided three accounts, each subdivided into two, with designations and instructions, taking "Shop Machinery and Tools" as an example, as follows:

"(a) Depreciation Estimate—'Shop Machinery and Tools.'

"a-1. Shop Machinery and Tools—Estimate.

"This account includes a monthly charge of one-twelfth of .... per cent per annum of the original cost (estimated, if not known) of shop machinery and tools in service to provide a fund for replacement when retired.

"a-2. Shop Machinary and Tools—Adjustment.

"This account includes the original cost (estimated, if not known) of all shop machinery and tools prematurely condemned, destroyed, sold or otherwise removed from service, less the amount previously charged for depreciation up to date of retirement and salvage recovered from final disposition."

C. Under the heads of "Depreciation Estimate, ...," in "Maintenance of Way and Structures," there are provided twenty-five accounts, each subdivided into two, with designations and instructions, taking "Rails" as an example, as follows:

"b-1. Rails—Estimate.

"This account includes a monthly charge of one-twelfth of .... per cent per annum of the original cost (estimated, if not known) of rails in service to provide a fund for replacement when retired.

"b-2. Rails—Adjustment.

"This account includes the original cost (estimated, if not known) of all rails prematurely condemned, destroyed, sold or otherwise removed from service, less the amount previously charged for depreciation up to date of retirement and salvage recovered from final disposition."

Of these three groups two, B and C, it is stated, have been included only for the convenience of those desiring to use them and are not at this time required, the explanatory note reading as follows:

"NOTE—Depreciation charges on maintenance of way property are not required at this time by the Interstate Commerce Commission. It is arranged, however, in this classification to introduce this account to provide rules for computing depreciation charges on maintenance of way property for the guidance of those carriers that desire to make such depreciation charges, and for the use of such commissions of the various states as may prescribe them."

In discussing depreciation Professor Adams further says:

"5. The monthly charges to operating expenses for 'depreciation' on the several classes of equipment will, of necessity, create or require corresponding liability accounts to which such depreciation may be credited. To that end carriers will be required, beginning ....., to set up an appropriate liability depreciation account for each of the several classes of equipment upon which depreciation is charged. These accounts should be designated as follows:

"(a) Electric Locomotives—Replacement.

"(b) Passenger Train Cars—Replacement.

"(c) Freight Train Cars—Replacement.

"(d) Electric Equipment of Cars—Replacement.

"(e) Work Equipment—Replacement.

"To these replacement accounts should be credited monthly the amount of accrued depreciation on each class of equipment, respectively. Such credits should invariably equal the gross charges to maintenance for depreciation."

On analyzing these instructions it is seen that two objects are sought through the establishment of depreciation of equipment accounts:

(1) The charging to operating expenses monthly of a sum sufficient to cover the depreciation of equipment that is accruing currently over and above that loss in value which is made good through current repairs and maintenance.

(2) A means whereby there will be charged to surplus or profit and loss, in the course of a number of years, representing the average life of the property subject to depreciation, a sum equivalent to the total depreciation of equipment that had already accrued prior to some fixed date, as, for instance, July 1, 1908.

The fact that these two objects are coupled does not mean that both are equal-

ly desirable or undesirable—each proposition should be considered on its merits. Concerning the first object, accounting for current depreciation month by month, the writer believes that since depreciation exists it should be accounted for as it accrues.

The depreciation of equipment which ultimately results in the need for renewals is an accrued liability and should have a place in the balance sheet. This being true, the corresponding debit should appear somewhere in the accounts.

Charging accrued depreciation to operating expenses or to income and crediting a reserve account can not affect the liability of a company to its bondholders, nor will such entries in the books, since they involve the payment of no real money, curtail the ability of the company to pay fixed charges. Further, such entries need not curtail the payment of dividends, but if the dividends are paid these entries will perform the important function of showing the stockholder that his dividend has come out of capital and not out of profits, and of showing the bondholder that his security is being impaired, facts which the investors and, in the case of a permanent institution like a railroad, the public should fully appreciate.

Whether these charges should be made to operating expenses or to income is perhaps open to argument, but it is the opinion of the writer that they should be made to income, first for the reason that depreciation is not an "expense" because it may not involve the payment of money (per contra, appreciation, if shown, would not be credited to earnings) and, second, because depreciation goes on independent of operation; especially is this latter true of that class of depreciation caused by the advancement of the art, sometimes designated as that due to obsolescence or supersession.

In considering the second object of the commission—the charging of depreciation already accrued to surplus—it is necessary to distinguish between companies having short-term franchises and those not so limited. As regards the former the accrued depreciation must be made good before the franchise expires or the investors —stockholders or bondholders or both— will surely suffer. With railway companies owning their rights of way, terminals, etc., in fee, the case is different and they perhaps can claim credit for the appreciation of the portion of their assets that is not subject to depreciation. This phase of depreciation accounting is discussed by Frederic A. Delano, president of the Wabash Railroad, in a paper published in the *Railway Age* of March 27, 1908, page 471. In this connection Mr. Delano says:

III. DEPRECIATION OF THE RAILROAD PLANT AS A WHOLE.

"(a) Steam railroads do not have to provide for any depreciation as against the expiration of a franchise, which, of course, is a serious item with public service corporations having limited franchises. Nor is there, in the case of steam railroads, a large share of the total investment in a central power plant which is becoming obsolete. In most cases the depreciation due to the diminished value of equipment, track, bridges, structures of all kinds, shops and shop tools already referred to, is limited, as has been explained, and is, furthermore, a good deal more than counterbalanced by the appreciation due to the fact that the age of the railroad has given it an established business. This amounts to a good deal more in the case of a railroad than what is called 'good will' in the case of a mercantile corporation. As a railroad is developed industries, mines, factories, etc., are established along its tracks, with switches and sidetrack facilities, towns grow up along it and a certain amount of business becomes assured to it—business which it takes years and a large expenditure of money and energy to develop—all of which is charged into current operating expenses and should be considered as an offset to any depreciation of the property.

"(b) Besides the appreciation due to this cause there is, of course, an actual physical enhancement of value due to the condition of the roadbed and embankments becoming better solidified, the water courses established and the original structures gradually replaced with others of a more permanent character, even without any addition to capital account; thus, wooden trestles, bridges, culverts, etc., have been filled with earth or replaced by steel or iron, stone or concrete.

"(c) No account is taken and no estimate can be made of the enhanced value of the railroad property (right of way and terminals) due to the enhanced value of the land, even though the existence of the railroad may have contributed largely to the development of the country through which it runs. The railroad corporation suffers by reason of this enhanced value which it has so largely contributed to create if it is compelled to purchase any additional property, as well as in the increased amount of the taxes it is called upon to pay each year as its contribution to the needs of the growing communities; but it has not been usual to make any allowance for this. Those who have had the greatest experience with railways generally believe that the enhancement in value or appreciation of the property in the direction already referred to far more than balances the depreciation, especially when it is remembered that the total physical depreciation under proper maintenance rules is, without doubt, limited to about half the first cost of the property subject to depreciation."

Strictly urban properties with limited franchises and those having tracks laid in the public highways can not avail themselves of these arguments to the same extent.

It may be desirable to cite some statistics to show how much those railways which undertake to care for current depreciation find it necessary to provide for this purpose. Here it is proper to say that expenditures for repairs, renewals and depreciation charges should all be grouped together, since any one of the three items taken separately means but little, because human nature is too apt to shift the dividing line between repairs and renewals according to the showing it is desired to make. Thus grouped it is found that the gross earnings per mile, the total of repairs, renewals and depreciation per mile, and the latter expressed as a percentage of the former are as shown in the accompanying table for the properties which are making the largest provision for current depreciation.

In addition to the electric railways given in the table, roads making charges for depreciation include the following:

The United Railways Company of St. Louis began, in January, 1905, to charge off five per cent of gross earnings, crediting it to a depreciation reserve. In 1906 the total charges for maintenance and depreciation amounted to 15.09 per cent of gross earnings. In 1907 the charge for depreciation was 5.08 per cent and the total of maintenance and depreciation was 18.69 per cent of gross earnings.

The Milwaukee Light, Heat and Traction Company began, in 1903, by charging five per cent of gross earnings for depreciation, increasing the proportion one per cent each year, so that the charge was nine per cent of gross earnings in 1907, and presumably is ten per cent for the current year. In 1907 the railway departments of the Milwaukee Electric Railway and Light Company and the Milwaukee Light, Heat and Traction Company showed gross earnings of $14,330 per mile of single track; maintenance was 10.28 per cent and depreciation 6.84 per cent of gross earnings.

The Wisconsin Traction, Light, Heat

and Power Company, of Appleton, Wis., in 1907 began to charge five per cent of gross earnings for depreciation, the intention being to increase the proportion gradually to ten per cent. The rate this year is six per cent. In 1907 the total of maintenance and depreciation for the railway department was 19.21 per cent of gross earnings.

The foregoing three companies are all under the management of John I. Beggs, who, it is believed, was the pioneer in this country in the matter of accounting for depreciation, having begun with the Milwaukee Electric Railway and Light Company in 1897.

The International Traction System of Buffalo, in its report for 1907, shows a depreciation charge of five per cent of gross earnings. In the 1906 report no such charge was shown, but in the 1907 report the figures for 1906 were differently stated to permit of comparison and the depreciation charge for 1906 is shown at about four and three-quarters per cent of gross earnings, this being subtracted from the operating expenses as shown the year before. Figures published in *American Street Railway Investments* show the total of maintenance and depreciation charges (no depreciation shown prior to 1906) in per cent of gross receipts for this system to have been as follows:

1903	1904	1905	1906	1907
7.52	10.00	9.48	14.17	15.03

This indicates that the proper interpretation was not placed upon maintenance until 1906. The maintenance for 1907 was assumed to bear the same ratio to depreciation as in 1906, in order to get the 15.03 per cent given.

The Twin City Rapid Transit Company (*Electric Railway Review*, September 14, 1907, page 301) began to establish renewal reserves in 1905, setting aside 7.14 per cent of gross earnings in 1905, 8.54 per cent in 1906 and 8.35 per cent in 1907. The totals of maintenance and renewal reserves in per cent of gross earnings have been:

1899	1903	1905	1906	1907
7.89	8.09	14.44	16.25	15.98

The new ordinances of the Chicago City Railway Company and the Chicago Railways Company specify that after the three-year period of rehabilitation at least six per cent of gross receipts shall be spent or reserved for repairs and that eight per cent of gross receipts shall be spent or reserved for renewals. The reserves are to be carried in cash with approved depositaries. In the case of the Chicago City Railway the total maintenance reported for the first half of 1907 was 13.05 per cent of earnings.

The Union Electric Company, of Dubuque, Iowa, began, January 1, 1906, to set aside twenty per cent of gross receipts for the purpose of maintenance and depreciation reserves. For the railway department in 1906 maintenance amounted to eleven per cent, leaving nine per cent of the gross receipts to apply on account of depreciation; in 1907 maintenance required seven and one-half per cent, leaving twelve and one-half per cent of the gross receipts for the depreciation reserve.

The British Columbia Electric Railway Company, Vancouver and Victoria, British Columbia, has for some years charged depreciation at the rate of five per cent on steam, electrical and water machinery, 3.5 per cent on rolling stock, ten per cent on poles, three per cent on lines, two per cent on track and one per cent on buildings.

The Kansas City Western Railway, operating between Kansas City and Leavenworth, and in Leavenworth, Kan., has adopted 7.5 per cent on steam and electrical machinery and rolling stock, five per cent on poles, fifty-five cents per ton on rails, 12.5 per cent on ties, ten per cent on paving and 2.5 per cent on buildings, as the annual depreciation charges.

Referring to the table the following points should be noted:

1. The steam railways have long included renewals in operating expenses and it is fair to presume that the maintenance expenditures shown include ample provision for current depreciation.

2. The percentages of 22 and 24, respectively, for the North Chicago and the West Chicago lines were fixed after a careful survey of the property and examination of the books by the company's engineers and by Stone & Webster. An account of this work was published in the *Electric Railway Review* of February 23, 1907.

3. The allowance for depreciation of the Milwaukee Electric Railway and Light Company, which is ten per cent of gross earnings, is not considered by the management to be as large as it should be. In replying to the inquiries in Accounting Series Circular No. 20 of the Interstate Commerce Commission, C. N. Duffy, comptroller of the company, said (*Electric Railway Review*, April 4, 1908): "This company believes in the principle of depreciation and the practical application of the principle in providing for depreciation in its accounts; it has recognized and applied this principle in its accounts since January 1, 1897. The provision for depreciation has not been to the extent the company considered necessary, but to the extent it was consistently able to provide and give to capital some measure of fair return on its investment."

From the foregoing arguments the conclusions are that current depreciation ought to be provided for and that when this is done the total charges for up-keep and replacement of the property of an electric railway will approximate one-quarter of the gross earnings. That is, one-fourth of the gross earnings should be sufficient if the road has a fair amount of traffic and a proper basis for fares.

An estimate of the amount of the charges for depreciation may be made in

DEPRECIATION IN ELECTRIC RAILWAY ACCOUNTING—GROSS RECEIPTS AND CHARGES FOR MAINTENANCE AND DEPRECIATION PER MILE OF SINGLE TRACK.

	Fiscal Year of	Total Gross Receipts per Mile of Single Track.	Total Maintenance and Depreciation per Mile of Single Track.	Maintenance and Depreciation in Per Cent of Gross Receipts.
Steam railways of the United States as reported to the interstate commerce commission	1899	$5,308	$1,313	24.74
Steam railways of the United States as reported to the interstate commerce commission	1902	6,453	1,684	26.10
Steam railways of the United States as reported to the interstate commerce commission	1904	6,815	1,779	26.10
Steam railways of the United States as reported to the interstate commerce commission	1905	6,956	1,837	26.41
Steam railways of the United States as reported to the interstate commerce commission	1906	7,526	2,019	26.83
Steam railways reporting to New York railroad commission	1905	10,548	2,674	25.35
West Chicago Street Railroad	[1]1904	26,857	6,445	[1]24.00
North Chicago Street Railroad	[1]1904	33,607	7,394	[1]22.00
Milwaukee Electric Railway and Light Company (railway department)	1906	[2]25,632	4,606	17.97

[1] Percentage is the same in 1905 and 1906. [2] Gross earnings.

another way. The reports of the Chicago Union Traction Company and the Glasgow Tramways committee show that where charges for repairs and for depreciation are carefully divided the latter is about one-third greater than the former. Analysis of the reports of electric railways to the railroad commissioners of New York, Massachusetts and Connecticut indicate that these companies are expending for "maintenance" about one-third more in proportion than the Chicago and Glasgow lines cited are expending for "repairs." From this it may be inferred that to provide for current depreciation would require an additional charge equal to seventy-five per cent of the usual charges for maintenance.

It is now in order to inquire what benefit may be expected from the assumption of a burden that must in many cases, for a time at least, prove to be very onerous, and the answer is that the policy must result in bringing about better relations between the public and the railways. With the facts honestly placed before the public it is not too much to hope that short-term franchises, unreasonable exactions as to compensation and inadequate fares will become things of the past. A beginning has already been made in Massachusetts where, within a few months, fares on several roads have been increased from five cents to six cents, or the five-cent zones correspondingly narrowed, and as this has the approval of the state railway commissioners the other improvements mentioned are not entirely utopian.

A Metallic Mirror for Searchlights.

A new type of mirror for searchlights is described in *Electrical Engineering* (London), April 9. This is manufactured by the Cowper-Coles electrolytic process and is intended to take the place of the ordinary metallic mirrors or the glass mirrors silvered upon the back. The process consists briefly of depositing by chemical means on the convex side of a glass former or mold a thin silver film and then spinning the former in an electrolytic cell charged with copper anodes and a copper electrolyte so as to deposit the copper on the silver surface, the process being continued until the silver film has received a sufficient thickness of copper to give the desired rigidity to the parabolic mirror. The glass mold and the electro-deposit are then removed from the depositing cell and placed in a vessel containing cold water, the temperature of which is gradually raised until the expansion of the copper is sufficient to cause the metallic mirror to leave the glass former. The silver-faced mirror thus produced has as highly polished a surface as the glass, and is finally subjected to an after-treatment to prevent the silver from tarnishing and then mounted in a metallic ring (which fits in the projector case) provided with knife elges, which firmly grip the edge of the mirror without distorting it. A large number of mirrors made by this process have been supplied to the British Government, some of which were sent out to the South African war.

Mr. Cowper-Coles is now introducing a new metallic mirror, which is only partially made by electro-deposition. The mirror has a surface composed of alternate bands or rings of gold and white reflecting surfaces which, it is claimed, give a more penetrating beam of light both at night and in foggy weather. Objects on which such a beam of light is thrown stand out in greater relief than in a light thrown from a silver white metal mirror, and the intensity of the light is so great that it is impossible to aim accurately at the projector. Another great advantage claimed for the new mirrors is that they are not fractured by concussion, and even when penetrated by bullets the area of distortion is very small.

National Architectural Exposition.

The first annual architectural exposition will be held during the week of September 14-19, at Madison Square Garden, New York city. All departments of architecture, engineering, painting, sculpture, the trades, manufacturing and craftsmanship pertaining to construction, equipment and decoration of buildings, as well as landscape and garden effects, will be exhibited.

Alfred Chasseaud is general manager, 1 Madison avenue, New York city.

Electrical Supplies for the Navy Department.

The Bureau of Supplies and Accounts will open bids in Washington, D. C., on May 12, for the following electrical material: 20,000 feet of cable, one motor and miscellaneous lighting wire, for delivery at Brooklyn, N. Y.; two feeder panels for delivery at Charleston, S. C.; miscellaneous lighting wire for delivery at Norfolk, Va.; motors and spare parts for delivery at League Island, Pa., and miscellaneous magnet wire for delivery at Portsmouth, N. H.

Summer Courses at the University of Wisconsin.

Engineering courses, laboratory practice and research work of interest to practising engineers, contractors and graduates of technical schools will be given in the coming summer session of the University of Wisconsin, Madison, Wis., beginning June 22 and continuing six weeks.

Work is offered in the following departments:

Chemical Engineering—Solid, liquid and gaseous fuels, interpretation of analysis, gas-meter proving, calorific and illuminating value of gas.

Electrical Engineering—Theory of direct and alternating-current machinery, illumination and photometry, calibration of instruments.

Hydraulic Engineering—Research and advanced laboratory investigation, turbine and pump tests, study of ground water flow, flow through pipes, wire measurements, calibration of instruments.

Steam and Gas Engineering—Thermodynamics, boilers, heat engines, valve gears, gas engines and producers, refrigeration, heating and ventilation, calibration of instruments, laboratory tests and investigation.

Mechanical Drawing and Machine Design—Elements of drawing, descriptive geometry, mechanism, design of machine elements and complete machines, methods of computation and drafting-room practice.

Mechanics and Testing of Materials—Class work in statics and strength of materials, lectures on the properties of iron, steel, wood, brick, cement and concrete, laboratory tests and research in strength and properties of materials, particular attention being given to plain and reinforced concrete.

Shopwork—Lectures on and practice in pattern making, machine work, forging and treatment of carbon and high-speed steels.

In addition to the above engineering courses, the eighth annual session of the Artisans' School will be held during the same period, in which instruction of a more elementary type will be given in the majority of subjects noted above, this instruction being adapted to the requirements of students who have common-school training or practical experience.

Bulletins describing the courses of study in detail in both schools may be obtained from F. E. Turneaure, dean, College of Engineering, Madison, Wis.

The Investigation of the Metropolitan Street Railway System, New York City.

The special county Grand Jury, which has, since January, been investigating financial institutions, the Metropolitan Street Railway system, and the American Ice Company, in New York County, state of New York, finished its work on April 20, and submitted a presentment stating that it could find no evidence sufficient to base an indictment against any one connected with the management of the Metropolitan Street Railway system. The Grand Jury took the unusual course of making public, with the approval of Justice Dowling, all the evidence it has taken on the subjects before it. According to the testimony of Thomas F. Ryan, Herbert H. Vreeland, Paul D. Cravath and others, large amounts of money were disbursed by the Metropolitan company for campaign purposes.

After considering all the phases of these transactions, the Grand Jury says that there was no evidence before it that would warrant it in bringing in an indictment, but that certain of the disbursements were deserving of severe condemnation. As to other campaign contributions, the "character of the expenditures was deserving of condemnation." There was nothing to show, however, that a crime had been committed under the law at the time the disbursements were made.

In connection with this investigation, Thomas F. Ryan gave out for publication, on April 20, a statement from which the following abstracts have been made:

In 1885 the Metropolitan Traction Company of New Jersey was formed to acquire street railways in New York. Its capital was $10,000,000; there was paid into the treasury in cash $6,000,000. Subsequently the capital was doubled and issued to the shareholders upon the same terms. Result, total capital issued, $20,000,000, representing $12,000,000 of cash paid in. The sale of the stock at 60 was wholly legitimate. It was a new venture and subscriptions were obtained with difficulty even upon the terms offered.

In 1892 the Metropolitan Traction Company of New York was formed with an authorized capital of $30,000,000. It bought all of the stock of the Metropolitan Traction Company of New Jersey, paying $120 per share in its own stock, amounting in the aggregate to $24,000,000, and sold the remaining $6,000,000 for cash at par. Result, total capital issued, $30,000,000, representing $18,000,000 of cash paid in.

In 1893 the Metropolitan Street Railway Company was formed as an operating company and acquired from the Metropolitan Traction Company the following stocks:

Chambers Street Ferry Co.	$800,000
Houston, West Street and Pavonia Ferry Co.	6,250,000
Broadway R. R. Co.	1,000,000
South Ferry R. R. Co.	150,000
Lexington Avenue R. R. Co.	5,000,000
Metropolitan Crosstown Co.	300,000
Columbus and Ninth Avenue R. R. Co.	3,000,000
Total	$16,500,000

These stocks had been bought from time to time by the Metropolitan Traction Company directly from the original owners and were sold by it to the new operating Metropolitan Street Railway Company for the same par amount ($16,500,000) of its own stock, which went into the treasury of the Metropolitan Traction Company. Result so far as outstanding shares were concerned, unchanged, to wit: Total capital issued, $30,000,000, representing $18,000,000 of cash paid in.

In 1896 the stock of the Metropolitan Street Railway Company was increased from $16,500,000 to $30,000,000 and the additional $13,500,000 was issued to the Metropolitan Traction Company in exchange for Broadway and Seventh Avenue and other stocks appraised at $9,000,000 and in settlement of indebtedness, amounting to $4,500,000 for construction. Result as to outstanding shares, unchanged, to wit: Total capital issued $30,000,000, representing $18,000,000 of cash paid in.

In 1897 the Metropolitan Traction Company was dissolved in order that the shareholders might come into possession of stocks resting directly upon the properties and franchises, its assets, consisting of $30,000,000 of Metropolitan Street Railway stock and $6,000,000 of debentures, representing enhanced values of securities owned, were distributed to its stockholders, share and share alike. The Traction company thereupon became extinct and was succeeded by the Metropolitan Street Railway Company. Result: Total capital issued, $30,000,000, representing $18,000,000 of cash paid in.

In 1898 and 1899 $15,000,00 of new stock was sold to stockholders at par and $6,000,000 of the proceeds was used to retire the debentures. Result: Total capital issued, $45,000,000, representing $33,000,000 of cash paid in.

In 1900 $7,000,000 of new stock was sold to the shareholders at 160. Result: Total capital issued, $52,000,000, representing $44,200,000 of cash paid in.

To the cash paid in should be added interest for the period during which it yielded no return in the form of dividends upon the stock which represented it. This amounted—from 1885 to 1894—to $5,040,000, thus making the total cash investment $49,240,000. From this sum, on the other hand, should be deducted $6,000,000 represented by the debentures distributed pro rata among the shareholders. This leaves $43,240,000 of actual cash investment, representing $52,000,000 of stock now outstanding, or $83.13 per share of $100 each.

The Lexington Avenue and Pavonia Ferry Railroad Company was incorporated in 1893 and authorized to issue $5,000,000 of bonds and $5,000,000 of stock. The Metropolitan Traction Company contracted to construct the railway, powerhouses, etc., and to obtain for the Lexington Avenue company the right to operate its cars on Twenty-third street and Broadway in consideration of its bond and share capital. The traction company then sold the $5,000,000 of bonds to the Central Trust Company, Guaranty Trust Company and Mutual Life Insurance Company for par and interest. This money was paid into the treasury of the traction company and used to construct the road.

The $5,000,000 of Lexington Avenue stock remained in the treasury until the Lexington Avenue company was consolidated with the Metropolitan Street Railway Company, whose entire share capital also was owned by the traction company. It was then cancelled.

The same procedure was followed in connection with the Columbus and Ninth Avenue Company, which issued to the traction company $3,000,000 of bonds (also sold at par and interest) and $3,000,000 of stock, also exchanged for Metropolitan Street Railway Company stock.

When the Lexington Avenue Company ($5,000,000 capital), the Columbus Avenue Company ($3,000,000 capital) and the Metropolitan Crosstown Company ($300,000 capital) were merged in the Metropolitan Street Railway Company all of the shares of these four companies were owned by the traction company, and the only actual result was the extinguishment of the stock of the three merged companies and the corresponding enlargement of the Metropolitan Street Railway Company's stock to $16,500,000, which continued to remain in the treasury of the traction company.

Two old companies held the franchise rights to operate cars on Thirty-fourth street. Their combined capitalization was: Stock, $1,300,000; bonds, $1,300,000. The traction company bought these securities from the original owners in 1894 and consolidated them into the Thirty-fourth Street Crosstown Railway Company, which issued $1,000,000 stock and $1,000,000 bonds, secured by a mortgage to the Central Trust Company, trustee. The old bonds ($1,300,000) were placed under this mortgage and are now so held by the Central Trust Company. The new $1,000,000 of bonds were sold for 105 and interest, and the proceeds went into the treasury of the traction company. The $1,000,000 of stock was pledged to the Guaranty Trust Company under the general mortgage of the Metropolitan Street Railway Company, and is now held by the Guaranty Trust Company, trustee.

Cash Provided for the London Underground Electric Railways.

The board of directors of the Underground Electric Railways Company of London, Limited, has prepared a circular to the noteholders and shareholders giving full details of the whole undertaking, earnings and capitalization of the controlled companies, and recommending a plan of readjustment. The share capital of the Underground Company amounts to £5,000,000, and under the plan of readjustment no assessment is asked for from the shareholders. The cash requirements of the company are to be met by the sale to Messrs. Speyer and their friends of £1,000,000 ($5,000,000) twelve-year five per cent prior-lien bonds, and Messrs. Speyer also agree to provide up to £300,000 ($1,500,000) for any possible deficiency in fixed charges during the next few years, "in order that the noteholders may not suffer so serious a reduction in their income as might otherwise be the case during the further development of the enterprise."

The plan of readjustment provides in substance that the company will pledge in addition to the £11,000,000 face value of stocks and shares now held by the London & Westminster Bank, Limited, as trustee for the noteholders an additional £3,500,000 nominal of tube shares and the equity in the power-house, and issue (against this total of £14,500,000 nominal of shares) the £1,000,000 prior-lien five-per cent bonds (mentioned above), £3,000,000 four and one-half per cent bonds due 1933 and £5,200,000 six per cent bonds due 1948.

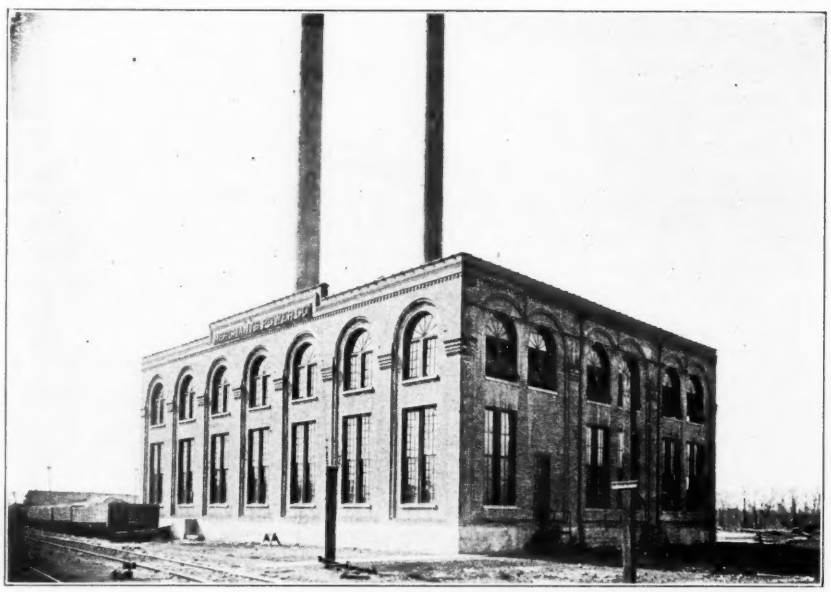
The proceeds of the prior-lien bonds sold to Messrs. Speyer & Company and their friends will be used to pay the company's temporary secured notes and outstanding commitments for construction, etc., while the $1,500,000 special interest fund is expected to be more than sufficient to make up any deficiency in the earnings to meet fixed charges up to July 1, 1912, after which date, if not before, the directors are of the opinion that the surplus income of the company will be sufficient for that purpose.

The plan is strongly recommended by the board of directors and has been formulated in consultation with Messrs. Speyer & Company, of New York, Messrs. Speyer Brothers, of London; Messrs. Teixeira de Mattos Brothers, of Amsterdam, and Mr. Lazard Speyer-Ellissen, of Frankfort, which banking houses are making the above-mentioned cash contributions and will act as readjustment managers without compensation. The plan is also recommended by London and Amsterdam committees of the noteholders composed of well-known men in those cities.

The Plant of the Merchants' Power Company, of Memphis, Tenn.

The Merchants' Power Company, of Memphis, Tenn., has completed a fine plant on the Wolfe River, about one and one-half miles from the centre of distribution to the city of Memphis. The building has a concrete foundation and is built of brick and steel, and designed with a view of extension at a later date. The basement is entirely enclosed in a concrete wall.

The capacity of the plant is 1,500 kilowatts, the equipment consisting of two 750-kilowatt Westinghouse revolving-field generators, star-connected for 2,300-4,000 volts, sixty cycles. The generators are direct-coupled to two cross-compound Allis-Chalmers engines, twenty-four by forty-eight by forty-eight, equipped with a 1,000-horse-power condenser for each engine and a 2,000-horse-power condenser connected to both, thus giving a considerable reserve capacity in condensers.



EXTERIOR VIEW OF THE MERCHANTS' POWER COMPANY'S PLANT, AT MEMPHIS, TENN.

The boiler room contains four Edge Moor water-tube boilers of 509 square feet of heating surface, in two batteries of two boilers each. These boilers are equipped with injectors, feed-water pump, both connected to the city water mains and condensing water. Water for the condensers is supplied from the Wolfe River.

Metropolitan injectors draw water direct from the cold-water suction line, delivering it to the boilers. The feed-water pump is a six by twelve-inch by eight by twelve-inch Smith-Vaile duplex, which delivers through a Cochrane open feed-water heater and feed delivery main which connects with all of the boiler units. The feed-water supply is taken from the Wolfe River or the city water mains.

The steam piping consists of a twelve-inch header in the boiler room adjoining the division wall for the high-pressure connections. From the high-pressure connections there is a seven-inch branch connection to each of the boiler units, and an eight-inch supply connection to each of the engines. The header is located above the level of the tops of the boiler settings, the boiler branches being run with long-radius bends. The engine-supply branches, however, drop through to the basement on the engine-room side of the division wall, where they are connected under floor to the engine cylinders.

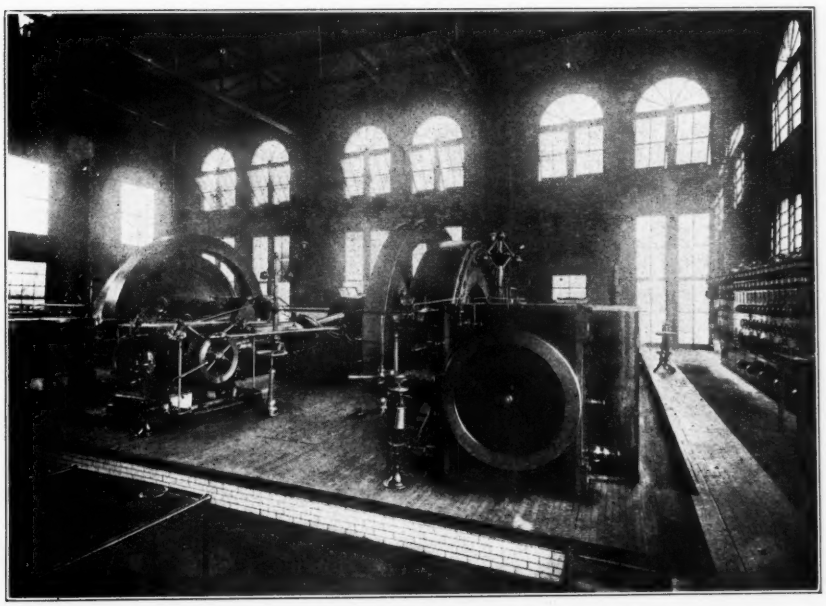
The exhaust-steam system consists of an eighteen-inch header in the engine-room basement, connected to the low-pressure cylinders of the engines by eighteen-inch branches, in addition to the local branch connections from the engines to the condensers. Both of the engines may be operated with a single condenser, if desired, by means of an exhaust header which is connected to the large condenser unit in the basement, this being placed between the two engines. This exhaust header has also a full-sized atmospheric connection which is carried through a back-pressure valve to a roof exhaust head.

The switchboard consists of two generator panels, one for each generator; one exciter panel, and five circuit panels, each equipped with five three-phase, four-

wire feeders extending to the city. Each circuit panel is also equipped with induction wattmeters, ammeters, recording wattmeters, regulators for each phase, and compensators to indicate the voltage at the end of the feeders.

A thirty-six-duct conduit extends from the plant to the city. In the city, branches are taken off to cover the business section, making about ten miles of distribution in the streets and alleys.

The distribution system is four-wire, three-phase, with grounded neutral both in primary and secondary. Each feeder supplies three 100-kilowatt, 2,300-volt transformers which feed into a heavy network, so that all sections are supplied with either three-phase or single-phase current.



Interior View, Plant of Merchants' Power Company, Memphis, Tenn.

This is a departure from the ordinary distributing system, giving the company the advantage of transmitting a portion of its current at 200 volts on its four-wire system. Had the attempt been made to have a straight three-wire system, the company would have had to be content with a 115-volt transmission. Light or power may be put in at any point by using the three-phase, four-wire system, whereas had a single-phase, three-wire system been used, the company would have had to run a three-phase, three-wire cable at any point where power was desired.

The two engines were put in service about a year ago, and are at present carrying a load of about 1,000 kilowatts, the system working very satisfactorily. The offices of the company are located at 22 North Second street, Memphis, Tenn., and the officers are: E. G. Cowdery, president; L. G. Van Ness, secretary.

World's Aluminum Output.

The aluminum industry throughout the world, says the *Wall Street Journal*, received a great impetus last year as shown by the gain of 5,300 tons in production over the preceding year, the 1907 output being 19,800 tons. All of the producing countries recorded increases in the output of this metal, as shown in the following four years' comparative statement of production in tons:

	1907	1906	1905	1904
United States..	8,000	6,000	4,500	3,900
Germany	4,000	3,500	3,000	3,000
France	6,000	4,000	3,000	1,700
England	1,800	1,000	1,000	700
World output..	19,800	14,500	11,500	9,300

Estimates of consumption for the four years mentioned show that the entire amount produced was used in the respective years.

Great secrecy has always surrounded the aluminum industry both in the United States and abroad. In this country the Aluminum Company of America, with several plants in the United States and Canada, controls the output of this metal on this side of the Atlantic. The industry started here with the production of eighty-three pounds in the year 1883. This has since gained to the above total.

Statistics on the world's aluminum industry show that back in 1855 the average price for this metal in Germany was 1,000 marks per kilo. As production increased and the industry gained headway the average price year by year dropped and the average price in the German market in 1907 was 3.25 to four marks per kilo.

Public Service Commission Reports on Brooklyn Bridge Service.

Commissioner Bassett, of the Public Service Board, to whom was given the task of improving traffic conditions on the Brooklyn Bridge, made a report to the commission last week showing that since September last there had been a material diminution in the number of delays of trolley cars on the bridge and that there had been a large increase in the number of cars, particularly in the rush hours. The time of delays has been reduced from 1,060 minutes in September to 385 minutes in March.

During the month of March 133,000 surface cars crossed the bridge, being an increase of 11,000 over the preceding September, which means that about 396,000 more seats were provided in March than in September. The average number of surface cars passing over the bridge in September in the evening rush hour was 288. In March this average was increased to 310.

At this time one year ago the largest daily number of surface cars that crossed the bridge was approximately 4,000. At present it is approximately 4,700, an increase of seventeen and one-half per cent. At this time a year ago the average number of surface cars crossing the bridge between 5 and 6 P. M. was 236; now it is 310, an increase of thirty-three and one-third per cent.

Marconi Wireless Telegraph Company of America.

At the annual meeting of the stockholders of the Marconi Wireless Telegraph Company of America, John W. Griggs, of New Jersey, was elected president, Guglielmo Marconi and John Bottomley being re-elected vice-presidents. The new executive committee includes these officers and John D. Oppe, James M. Townsend and James W. Pyke.

The report for the year ended January 31, 1908, states that the results of workings during the year showed considerable improvement. During the period 579,322 words were transmitted from and received at the various stations owned and controlled by the company, as against 485,023 words in the previous year. The gross receipts increased $8,350 and expenses decreased $3,293. During the year thirty-three ships were fitted with the Marconi system and six additional vessels accepted long-distance receiving apparatus. Numerous other passenger steamers trading between England and the Far East were fitted with the Marconi system.

NEW-BUSINESS METHODS.[1]

BY L. D. MATHES.

So-called "new-business methods" are as many as the sands of the sea. Every ambitious central-station manager we come in contact with has his own pet scheme, which in his opinion is the most effective in inducing the individual who is not a consumer to become a convert to the "matchless light."

We hear so much of "new-business methods" just at this time for the reason that the systematic solicitation of business has until the last few years been very much neglected. The results realized from time and money spent in popularizing with the general public the use of our service have been so satisfactory that companies large and small the country over are giving freely of their time and money to issues which have but lately been recognized.

In the mad rush to devise new and effective methods many fanatical schemes have from time to time developed. Some time ago in one of our neighboring states an enterprising manager gave a purse of $100 and some household furnishings to a pair of individuals who agreed to bring their fond hearts into perfect synchronism on the top of a 200-foot smokestack which the electric lighting company had just completed. Efforts of this character, in my opinion, are misdirected. We should regard that the sale of electricity is as dignified and requires as high a class of salesmanship as that involved through the sale of stocks and bonds or real estate.

Publicity is the foundation of our business, and publicity means advertising. Every company can afford to advertise to some extent. If the methods of the conservative companies were analyzed, it would be found that the majority have adopted systems which involve the use of newspaper space, the circulation of a monthly bulletin, the issuance of circular letters, and, more effective than all combined, the service of a corps of well-informed solicitors. Through the columns of the press we gradually impress on the people the character of our business; the bulletin informs the prospective customers in detail of the many purposes to which electricity can be applied; the circular or direct letter deals more particularly with practices which we recommend to those engaged in a particular line of business. The solicitor is the combination of all of the above forces; he is the individual who puts the finishing touches to the education we have been giving the prospect, and is supposed to come romping home with the contract.

It is unnecessary to state that we must first of all provide the public with a reliable and in every way satisfactory service; then that our prices are such that we can compete from a financial point of view with other agencies which may be offered. It does not hold that our price must be lower than that of the gas man, or than the cost of operating a gasolene plant. The public is becoming more and more discriminating and more willing to recognize quality. Many lighting companies are successfully competing with other systems of illumination through the frank avowal that their service does cost a little more than gas or gasolene, but the quality of the goods delivered is so superior, and the advantages of its use so many and so apparent, that the electric service is really cheaper after all.

There is a country-wide interest just at present in the establishment of display rooms. With the larger companies this is a simpler matter than with their smaller brothers, for the reason that the stock-room affords a greater variety of appliances and fixtures which can be turned into the display room for demonstration purposes. On the other hand, the smaller company is not expected to go into the matter so elaborately, as its customers do not incline to the purchase of the high-priced devices, such as motor-driven washing machines, sewing machines, vacuum-cleaner outfits, etc. Every company, no matter how small, can make an effort along the display-room line, if it is nothing more than a half dozen of fans, a number of electric irons, a few heating pads and a dozen assorted heating devices, such as the chafing-dish, percolator, hot-water heater, etc. The importance of keeping this equipment bright and clean is more essential than many of us think. The writer has observed displays which would, from the dirt and dust and fly-specks on the units displayed, do more to discourage a purchaser than to induce him to purchase. Another important thing to carry in mind is not to exaggerate possibilities of the line displayed. Don't tell the customer he can boil a quart of ice-water in a minute on the consumption of that portion of wattage which would run the heater to its capacity for an hour at, say, 500 watts.

The most effective method, in my opinion, to push this line, and in fact all things electrical, is to be extremely liberal in your demonstration and guarantee. Tell the customer he can take an iron home and keep it for a month; if he is not satisfied, bring it back and get his money; or, better still, don't take his money until he has had the unit in service for a month. If the iron or any other devices burn out and it is not due to carelessness on the part of the customer, give him the renewal without question. Our company puts out everything that way. If we haven't the unit in stock that a customer is interested in, we send and get it. We have put out several hundred irons, a lot of toasters, several lots of heating pads, coffee percolators and other devices electrical. The cases wherein the units were returned are exceptional.

Getting away from generalities and down to the best proposition now before the fraternity for the increase of business, will call your attention to the tungsten lamp—the one great development in the incandescent field since its original invention—the unit which is revolutionizing interior illumination. That portion of the public which refuses to recognize quality, and insists on a low price regardless of efficiency, we have for years been unable to successfully divorce from the gas man. The tungsten lamp will do the work. You can sell the customer the lamp and permit him to pay for his renewals with the result that he gets a superior illumination, and at a price which is as good, or better, than that resulting from the use of any of the other methods encountered.

A gentleman in this state remarked to me a few days ago that a continuation of the improvement in the incandescent unit would put us all out of business; that the tungsten lamp delivering the same candlepower at half the wattage, as applying with the most efficient lamp on the market until the advent of the tungsten, would cut his gross receipts in two. This would appear to be the case in theory, but there is no reason for it to work out in fact. The average customer feels to spend a certain amount for lighting; if you can give him a better effect and not increase his costs, he as a rule is satisfied. This means that with the new lamp we must make an effort to get the customer to install that number of units which will give him a vastly improved illumination, and including his renewal cost, still not exceed his old-time billings. The consumer will very readily come around to burning his installation longer hours if the more efficient unit permits him to do so without increasing his bills. Then

[1] Read before the Iowa Electrical Association, Des Moines, Iowa, April 23.

there is the matter of the expansion of your business—getting into fields which have before been closed; the tungsten throws down the bars to everything to the central-station man.

One could talk indefinitely on "new-business methods" and quote from the practices of the master minds of the profession, but it would be impossible to devise a plan for universal application. While much of the commercial propaganda evolved by the recognized authorities of our profession can be modified to apply to our particular case, we must recognize the fact that each manager confronts a situation just a little different from that which would present in another community. Which means that when we reach rock bottom it is a case of conforming to, as far as possible, local conditions—studying the requirement of the individual and giving him that service which is best adapted to his needs. Always be honest with the customer. Don't lead him into, or permit him to lead himself into, extravagant effects—installations which will run into larger lighting bills than his business can afford. Tell the customer you want his money, but you want to give him a good run for it, and it is not to your interest to see him burn more current than he actually requires, or that the magnitude of his business warrants. It may sound like a joke to some of you hard-shelled monopolists, but I really believe that the adoption of the "Golden Rule" policy by the electric lighting fraternity will work out vastly to the benefit of all of us.

Dynamo-Clause Reform in Standard Insurance Policy.

An effort is being made to bring about a reform in connection with the use of the dynamo or electrical exemption clause when included in policy form covering plants wherein electricity is generated. These forms usually contain the exemption clause as follows:

"This company shall not be liable for any loss or damage caused by artificial electric current, to dynamos, exciters, lamps, switches, motors or other electrical apparatus, or equipment hereby insured, unless fire ensues, and then for loss or damage caused by the fire only."

It has been pointed out that a large majority of such forms also include the straight lightning clause, which destroys the effect of the exemption clause or makes the policy ambiguous. It is suggested that companies insist upon the use of the clause, "lightning clause excluding damage to electrical apparatus," whenever policies cover upon dynamos and electrical appliances.

American Railway Association Acts on Rail Standards and Adopts Clearance Diagrams for Third-Rail Working Conductors.

The spring session of the American Railway Association was held at the Hotel Belmont, New York city, on April 22. W. C. Brown, senior vice-president of the New York Central & Hudson River Railroad Company, presided. The executive committee reported that the membership of the association now comprises 338 members, operating 240,770 miles of road, and the associate membership comprises forty-four members, operating 1,630 miles.

The Committee on Standard Rail and Wheel Sections submitted a report and presented a series of rail sections of two types and specifications for bessemer and open-hearth steel rails. On the recommendation of the committee, the association adopted resolutions providing that the gauge of track be measured between the heads of rails at right angles thereto, at a point five-sixths of an inch below the top of the rail, and that the standard distance between the main rail and the guard rail, and in the throat of all frogs, be one and three-quarters inches, measured at the gauge line for all tracks of standard gauge. A resolution was also adopted by the association providing that the two types of section of and specifications for the standard rail submitted be referred to the American Railway Engineering and Maintenance of Way Association, with the request that it consider the subject fully and submit to the association a single standard for adoption.

The two types of heavy rails adopted differ widely from the many types now in use. Type "A" must weigh from sixty to 100 pounds per yard, and type "B" the same, the only difference in the two types being in shape and measurement, ranging from three and eleven-sixteenths inches at the base for the latter type, to eight and one-half inches for the former.

The Committee on Standard Location for Third-Rail Working Conductors stated that a circular had been issued, giving suggested clearance diagrams for third-rail working conductors, and upon its recommendation the association adopted the following resolutions:

"WHEREAS, There is a constantly increasing number of roads being equipped electrically, which roads, in the natural course of business, interchange rolling stock with other lines not so equipped, and

"WHEREAS, Unless lines of clearance for both rolling stock and maintenance of way structures are established, so that such interchange can be effected without interference, great inconvenience and expense will inevitably follow; therefore,

"*Resolved*, That the diagrams showing lines of clearance as presented in the report of the committee on third-rail working conductors, dated March 23, 1908, be approved and made the standard of the American Railway Association; and that in the future construction of rolling stock and roadways these clearance lines be carefully adhered to by the members of the association."

The following officers were elected: President, F. A. Delano, president of the Wabash Railroad; second vice-president, W. A. Gardner, vice-president of the Chicago & Northwestern; members of executive committee—H. U. Mudge, second vice-president of the Rock Island; J. Kruttschnitt, director of maintenance and operation for the Union and the Southern Pacific systems.

The Iglesis and Regner Train-Lighting System.

A description is given by S. Iglesis in the April issue of *Lumiere Electrique*, of a train-lighting system employing a constant-potential variable-speed dynamo which has some interesting peculiarities. One of these is the automatic method of reversing the dynamo connection with a change in direction of rotation and of connecting and disconnecting the main switch according as the speed is above or below a certain value. This is accomplished by the direct movement of the body of the dynamo, which is switched on bearings and when inoperative hangs vertically. In this position the two brushes are at the points of no potential. Whenever the armature begins to rotate in one direction or the other, a current is taken off by means of a third brush placed upon a slip ring connected through a resistance to one of the generator brushes. This, of course, gives rise to a torque which tends to drag the body of the dynamo into a horizontal position in one direction or the other, according to the direction of rotation of the armature. When the speed has reached a point so that this torque is sufficient to bring the body of the machine into a horizontal position, the main switch is automatically closed in the proper direction, as at this speed the generator develops the proper potential for charging the batteries or supplying the lamps on the train. This movement also cuts out the auxiliary circuit employed for giving the initial torque.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

Coloration of Glass and Quartz by Radium.

A brief note by C. E. S. Phillips deals with the effect of radium on glass and quartz. Attention has frequently been called to the coloration which takes place when these two materials are exposed to the rays from radium. The coloration of glass is mainly attributed to the presence of manganese or lead, and the author suggests that the coloring of quartz is also due to some foreign substance with the silica. To test this he exposed a small plate of quartz crystal to radium for three weeks, when it had become not only irregularly violet at one place, but showed two sharply defined parallel lines strongly colored, with the space between them scarcely affected. On the other hand, a quantity of powdered, chemically pure silica acquired no color after the same exposure. Furthermore, pure boric acid fused to a transparent plate and protected by moisture was unaffected by radium after two months' continuous exposure to the rays. Borax, however, will show a slight action after three weeks. The author notes that both of these substances, when incorporated with a small quantity of pure sodium silicate, form a good basis for the production of experimental glasses for testing the action of radium when other constituents, such as lead and iron, are present. It is suggested that the coloration by radium may serve as a test for the purity of the silica used in making quartz vessels for chemical purposes.—*Abstracted from Nature (London), April 9.*

The Completion of the First Tramway Subway in London.

An extension connecting the subway under Aldwich with the street railway on the Victoria embankment, London, has been completed, and a service of single-deck cars is to be provided from the extreme north of London over Westminster bridge to Kennington gate and to the tower by means of this connection. This gives a point at Waterloo bridge which is practically the junction for three through routes, north, east and west. The new construction is only about a furlong in length, but has cost between $250,000 and $300,000. This is at the rate of about $2,500,000 a mile. The subway is entirely under Wellington street and the approach to Waterloo, both of which are subject to the jurisdiction of the London County Council. The subway begins with an incline of about one in twenty from the King's Way to the Strand, then a short down-grade of one in 108 under the Strand, followed by a level stretch 500 feet long to the embankment. The portion of the subway from the Gaiety Theatre to about one-third of the way down Wellington street consists of two pieces of straight track joined by a gentle curve. This is laid in separate single-track tubes. From here to the end of the tunnel it is constructed for a double line with a cross-over in the centre of the length, and from here there is a gentle reverse curve terminating in a short piece of straight track at the mouth of the tunnel. The approach to the bridge is carried over the line on a series of brick arches, and the work of driving the tunnel beneath this apparently had no effect upon it. The entire work is very massive in construction, concrete being used largely, the whole structure, in fact, resting upon an immense raft of concrete.—*Abstracted from the Tramway and Railway World (London), April 2.*

The Ondemeter.

Among the many devices constructed for measuring the wave-length of electrical waves used in wireless telegraphy, that devised by O. Rochefort is thought by G. Marie to be the most useful. Monsieur Marie, who is electrical engineer for the Compagnie Generale Radiotelegraphique, describes this apparatus here and says that it has given excellent results in practical use. The device is based upon the use of an inductance coil which may be varied perfectly continuously. This is connected in series with a condenser of variable capacity, and the whole is placed directly in the oscillating circuit, or in inductive relation thereto. The inductance consists of two coils of wire mounted on spools, one of which may be revolved within the other by means of a spindle and a controlling handle. These two are connected in series, and the inductance of the combination may be varied, by turning the coil through 180 degrees, from nothing to a maximum value. The capacity consists of a number of condensers which can be grouped successively by means of a commutating switch. The indicator may be either a bolometer, a thermoelectric element or a thermo-milliampere meter. This indicates when resonance has been secured, since the current flowing is then a maximum. When this relation has been obtained a scale on the inductance coil indicates directly the wave-length of the oscillation. When it is thought undesirable to place the indicating instrument directly in the resonance circuit of the apparatus, it may be connected inductively by means of a single turn of wire wound about the stationary coil. In use, the apparatus is placed either in the oscillating circuit or in inductive relation thereto, and the inductance coil varied until the maximum current is obtained. If a maximum can not be reached, the commutating switch is adjusted to vary the capacity and another trial made until the desired condition is obtained. — *Translated and abstracted from L'Electricien (Paris), April 11.*

A New Apparatus for Measuring Electrolytic Resistance.

The measurement of electrolytic resistance differs from that of the metallic conductors in several respects, the most noticeable being the fact that the electrolyte has no definite shape or size. Cells of various forms have been devised for measuring such resistances. The one described here by A. W. Smith was designed with the object of presenting the concept of molecular conductivity in such a clear and concise form that no one who is capable of making electrical measurements can misunderstand it. The apparatus consists of a strong glass tube provided with a small side tube for filling. Both ends are ground plane and closed by platinum fixed electrodes, the whole being firmly clamped together in a suitable framework. Insulating between electrodes is provided by making a portion of this framework of ebonite. Crushing strains, due to the unequal contraction of glass and metal parts, are avoided by the use

of heavy rubber washers, one on each side. A moderate pressure is sufficient to prevent leakage between the ends of the glass tube and the metal electrodes. The resistance of the liquid contained in this tube is measured by a Wheatstone bridge, using a telephone and alternating current. The specific resistance of the electrolyte is then given directly from the dimensions of the tube, the converse, of course, being the specific conductivity. Since the conductivity of an electrolyte depends upon the amount of the substance in solution, the term "molecular conductivity" is convenient, this being that specific conductivity per gramme molecule of salt within the cube. This quantity is, of course, known when the concentration of the electrolyte is given. This apparatus is not intended for scientific researches, but simply for instruction, although it has been used satisfactorily for certain investigations.—*Abstracted from Science (New York), April* 17.

Electrical Discharges Through Gases.

In a lecture before the Royal Institution, of London, on electrical discharges through gases, Dr. J. J. Thomson discussed the action of discharges across very small spark-gaps. Two types of gap may be considered: those in which the path between electrodes is comparatively long —of the order of one millimetre or more; and those in which it may be compared with the wave-length of light. With gaps of the first class it is found that the difference of potential required to produce a spark of constant length decreases directly with the decrease in gas pressure to a certain minimum, which in the case of air is about 350 volts. On still further reducing the pressure of the gas the potential needed rises rapidly to very high values. There is thus for every spark-gap a critical pressure. These facts are included in Paschen's law, which states that the potential difference needed to produce a spark depends only on the quantity of gas through which the spark must pass, and if this quantity be kept constant, by varying simultaneously the pressure and the width of the gap, the potential required to pass the spark will remain constant. This law has been found to hold in all cases. This potential is the minimum for a certain value of the product of the pressure by the width of the spark-gap, and its value is fixed by the condition that the distance between the electrodes must be a certain multiple of the free path of the molecules. For air, the spark passes most easily when the distance between the electrodes is ten times the main free path of the molecules. The existence of this critical value is evidence of the discontinuous structure of gases. Paschen's law, however, does not hold for exceedingly small air-gaps. It has been found that when the spark-length is so small that it may be measured conveniently in the wave-length of sodium light, the potential required to pass a spark decreases with the length of spark down to a certain point where it becomes constant. For air this potential has a constant value at about 350 volts. As the gap is still decreased, eventually a point is reached where the potential begins to drop rapidly along a straight line passing through the origin. The horizontal portion of the curve is due to the shape of the electrodes used in the experiment, one of these being flat, and the other spherical, so that the spark was free to choose its critical length of path. It is also found that, for longer sparks, the critical potential is different for different gases, and for minute sparks it is independent of the gas, but varies with the nature of the electrode. This potential gradient is of the order of about 1,000,000 volts per centimetre, which is comparable to the dielectric strength of liquid and solid dielectrics. Dr. Thomson also called attention to the character of the discharge when the spark is passed rapidly, as for example, from a charged Leyden jar, which did not allow time for the usual phenomena to put in an appearance. Such discharges give a uniform appearance and are not striated, and the spectra of the elements are different from those obtained by the ordinary type of discharge.—*Abstracted from Engineering (London), April* 10.

The Effects of "Leakance" and the Use of Heaviside's Distortionless Condition in Telephone Transmission.

It has been stated frequently that an increase in "leakance" would to a very considerable extent improve the transmission qualities of the telephone line. The theory of this improvement is based on the fact that with the right relationship of "leakance" to the other factors in the line, the attenuation over a considerable range of frequency is the same, and the circuit, therefore, approaches a distortionless one. It is here pointed out by B. S. Cohen that when the practical application of "leakance" is considered, it will be found that with the dimensions of the factors for the general run of commercial telephone lines, any increase in "leakance" sufficient to give the distortionless condition is accompanied by such an increase in attenuation as to render the line unworkable in the greater number of cases. To obtain the distortionless condition on an ordinary twenty-pound-conductor cable line requires a decrease of insulation resistance down to 200 ohms per mile loop, and the attenuation is increased six-fold. The improvement which this gives in articulation is quite overbalanced by the increase in attenuation, and the net audibility of the line is diminished. The same thing applies even more strongly to ten-pound-conductor cables. When, however, open-wire circuits of fairly heavy gauge are considered, the distortionless point is reached with a much higher insulation resistance. For example, with 400-pound open wire, with an insulation resistance of 80,000 ohms per mile, there is no distortion, while the attenuation is increased only 1.9 times. But even on this type of line it is doubtful whether the improvement in articulation, when set off against a ninety per cent decrease in volume, would result in an improvement in the audibility. On the other hand, when loaded lines are in question the "leakance" must be kept quite small. Heaviside's theoretically distortionless condition has very little bearing on the practical problem, and it must not be forgotten that many arrangements of factors which will give this condition may be quite impossible in practice. As a matter of fact, a considerable deviation is not only permissible, but desirable. In a loaded line a close approximation to the distortionless condition can be obtained in practice for all inductances between the practical loading limits of 0.05 henry up to about 0.4 henry per mile on lines of negligible "leakance." Careful articulation tests have been made on such lines and it has been found impossible to detect the difference between such lines and a theoretically perfect distortionless line. Inductance coils with iron cores are now constructed with inductances up to about 0.4 henry per mile, and having an effective resistance so small that losses due to this are negligible. The author concludes that telephone engineers should not imagine that low insulation on telephone lines may be of benefit. The opposite is the case, as it is essential that all lines, whether cable or open wire, loaded or unloaded, should be kept at the highest practical insulation point consistent with economy.—*Abstracted from the Electrician (London), April* 10.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Oil-Break Circuit-Breakers for Low-Tension Alternating-Current Circuits.

Oil-break circuit-breakers are now largely used for the protection of alternating-current circuits of 600 volts or less, as the same qualities which have brought the oil-break switch into almost universal use for interrupting high-tension circuits, have recommended it to engineers for low-tension work. The new type I circuit-breaker, shown in Fig. 1, manufactured by the Hartman Circuit-Breaker Company, of Mansfield, Ohio, has been designed especially with a view of furnishing a low-priced protective device for alternating-current circuits of 600 volts or less. They are made for capacities up to 600 amperes for either switchboard or wall mounting, single or double-throw, plain overload release or combined overload and low-voltage release. The wall-mounting form, shown in Fig. 2, is especially well adapted for the protection of induction motors in mills and factories, as it can be installed on any convenient post or wall. One of the standard forms is a double-throw switch combining the features of an auto-starter with those of a circuit-breaker. This switch is automatic on the running side and also on the starting side under certain overload conditions. The auto-transformers used in connection with the same are mounted on the supporting frame with the circuit-breaker, the layout being thus entirely self-contained and easy to install. Both transformer and switch parts are enclosed in a heavy sheet-metal case, which serves the double purpose of preventing the operator or workmen from coming in contact with the live parts and as a protection against dirt and dust. Three taps are provided on each transformer so that the voltage on the starting side can be made fifty, sixty-five or eighty per cent of the full line voltage. When the switch is thrown over to the running side, the transformers are cut out of circuit.

The device, in short, combines the features of an oil-immersed auto-starter with those of an overload and low-voltage circuit-breaker, and the combination can be furnished for a lower price than is usually paid for the auto-starter alone. The contacts are of the laminated type, protected by auxiliary or arcing contacts which can be easily replaced should they become burned away in the course of time. A powerful toggle action is secured at the final closing movement, which brings the movable contacts tightly against the laminated brushes and produces the perfect self-cleaning contact shown in Fig. 3. In the construction of the operating mechanism the use of small, delicate parts has been avoided and the levers and toggles are amply large and strong. All bearings are of dissimilar metals so that they can not rust tight. The construction is rugged throughout and made to withstand hard usage.

For single-phase circuits the circuit-breaker is provided with one overload coil; for two and three-phase circuits, it can be furnished with an overload coil in one or two phases as may be desired. Low-voltage release can be furnished either alone or in combination with a single or double overload coil. The latter construction is used in the wall-mounting form shown in Fig. 2.

Both overload and low-voltage release are arranged so that the circuit-breaker

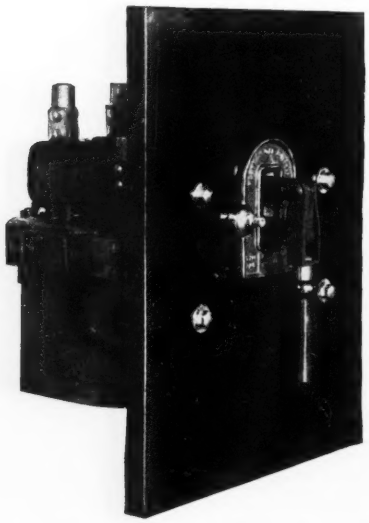


FIG. 1.—HARTMAN TYPE I, THREE-POLE, SINGLE-THROW, AUTOMATIC OVERLOAD AND LOW-VOLTAGE OIL CIRCUIT-BREAKER FOR SWITCHBOARD MOUNTING.

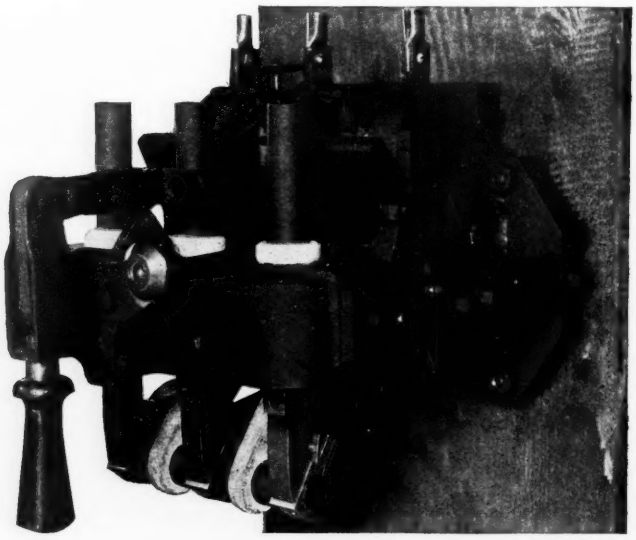


FIG. 2.—HARTMAN TYPE I, THREE-POLE, SINGLE-THROW, AUTOMATIC OVERLOAD AND LOW-VOLTAGE OIL CIRCUIT-BREAKER FOR WALL OR POST MOUNTING.

FIG. 3.—CONTACT OF HARTMAN TYPE I CIRCUIT-BREAKER.

will trip should the operator attempt to close the same while low-voltage or over load conditions exist.

A large number of combinations of this switch are being built to meet the various conditions of alternating-current generator and motor service.

Studio Lighting with Enclosed Arc Lamps.

It is generally supposed that it is impossible to do color work requiring any degree of exactness under anything but daylight. And it is true that practically all artificial illuminants as ordinarily used are unreliable for accurate color work. The importance of the demand for an illuminant for such work can readily be realized when we consider the number of commercial processes in which color determinations are required. This includes the manufacture and use of all sorts of pigments, dyes and paints, as well as many kinds of textile materials, fine leather and wood working. All such processes are limited to the daylight hours and well lighted buildings, unless the proper artificial illuminant is used. This limitation becomes quite a hardship, particularly where the business demand is high during the short winter days. The condition is often further accentuated in large, crowded cities, where suitable day lighting is not easily obtained.

STUDIO OF THE CHICAGO PORTRAIT COMPANY.

SHIPPING-ROOM OF THE CHICAGO PORTRAIT COMPANY.

In response to the demand for a suitable substitute for daylight, experiments have been carried on for several years under the direction of the illuminating experts of the General Electric Company. The enclosed arc lamp was the most promising illuminant available. As ordinarily used the arc is found to be only fairly satisfactory. Extensive tests and practical experience showed that the desired improvement could be obtained by satisfying the following conditions:

1. Increasing the current of the direct-current lamp to about 6.5 amperes and of the alternating-current lamp to eight or nine amperes.

2. Diffusing and mixing the light thoroughly, with properly designed reflectors and shades.

3. Insuring a sufficient intensity for the degree of accuracy desired.

Applying the above principles, successful installations have been made in worsted mills, color engraving establishments, button factories, dry goods stores and many other places where color values are important.

An interesting installation of this type has been placed in the studio of the Chicago Portrait Company. In this company's large studio, which has an area of about 3,000 square feet, are employed from 100 to 125 artists, sketching in and coloring photo enlargements. The studio is provided with a saw-toothed roof and finished in a dull neutral gray, which provides an even, soft daylight illumination. The dull finish of the room makes it somewhat difficult to light artificially, yet under the pressure of the busy season, the work has been carried on satisfactorily in the evening under the artificial light. The following extract from a letter by Mr. J. S. Sharp, office manager, tells how the lighting system has fulfilled the color requirements:

"We are using fourteen of your suspended ceiling-type diffusers, and are highly pleased with the results. We have been very successful in matching colors with this method of illumination.

"The almost perfect diffusion has reduced the shadows to the minimum. We are glad to recommend their use where a soft, white light for matching colors is desired."

The large studio is lighted by means of nine six-ampere, enclosed arc lamps with the suspended ceiling-type diffuser which has been developed by the General Electric Company. The lamps are hung about fifteen feet from the floor. In addition to this, a unit of the same type illuminates a small private studio. Four projecting type ceiling diffuser equipments with 6.5-ampere lamps illuminate the shipping room. The shipping room, in which portraits receive their final inspection contains about 1,700 square feet of floor area and employs from fifteen to twenty-five inspectors and shippers.

The accompanying illustrations, which were taken at night, purely by the light of the lighting installation, demonstrate the character of the room and the evenness of the illumination.

Tungsten Lamps in Competition with Gas Arcs.

The following interesting information is supplied by H. A. Fee, manager of the Citizens' Light and Power Company, of Adrian, Mich., through the courtesy of the F. Bissell Company, Toledo, Ohio:

An installation of twenty-four eight-candle-power incandescent lamps in the drug store of Hart & Shaw, proving unsatisfactory, was replaced by three three-burner gas arcs. These took gas at the rate of 44.063 cubic feet per hour, which, at fourteen cents per hundred, would make the cost of gas $61.69 per 1,000 lamp-hours. Adding $6 for maintenance (twenty-five cents per month per lamp), the total cost of gas operation for 1,000 hours is $67.69.

These gas arcs were replaced by twelve forty-watt tungsten lamps in ceiling receptacles; actual current consumption, 437 watts; average illumination, considerably above thirty-two candle-power. They give more light than the gas arcs did, better distribution and are not provided with proper glassware at that. The rate for this business is eight cents per kilowatt-hour, making the cost $52.96. The customer is greatly pleased with the change and is allowing the lighting company to advertise this fact.

Tests covering 570 hours' burning under voltage five per cent above normal two-thirds of the time show that the tungsten lamp will withstand these variations and maintain its initial candle-power.

Motor-Driven Pumps.

The great advantage and convenience of the modern Crocker-Wheeler circular form of electric motor over the older type is perhaps in no case better illustrated than in motor-driven rotary pumps and blowers. The standard types of motors are of approximately the same diameters as pumps of corresponding capacity, which produce sets of neat and compact design. The advantage is not of appearance only, as saving of floor space is in most cases an important factor. The pumps shown in Fig. 1, for example, having a combined capacity of 2,400 gallons per hour against a 100-foot head, require floor space of only two by three feet, and the combined height of the two pumps, as shown in the illustration, is less than five feet.

In addition to its compactness the circular form of motor is easily provided with covers in cases where the presence of dust or moisture makes them advisable.

Motor drive for pumps is in all cases advantageous, owing to the possibility of entirely automatic control. A tank switch, operated by the rise and fall of the liquid, or a pressure switch in the case of compressors, closes and opens the circuit automatically, operating an automatic self-starter which controls the pump motor.

In the case of blowers, speed control is another important consideration. In some cases this is also made automatic by means of a thermostatic device, to regulate temperature by the volume of air blown past a heater. It is due to the ease of control of the electric motor that fans and blowers have come into general use for heating as well as for cooling.

Noiseless running is another point which may be mentioned in favor of motor drive for pumps. This is particularly important in hotels, shops, restaurants, etc., where the noise of reciprocating parts is a source of annoyance to patrons and tenants, and thereby a loss of patronage to the proprietor.

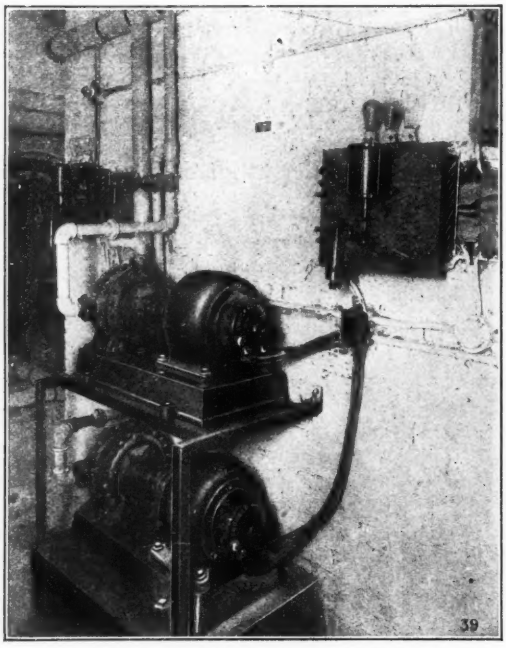


FIG. 1.—TWO TWO-STAGE TACONY TURBINE PUMPS, WITH CROCKER-WHEELER MOTORS.

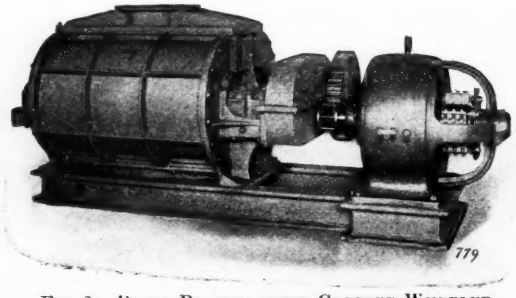


FIG. 2.—PIQUA BLOWER, WITH CROCKER-WHEELER MOTOR.

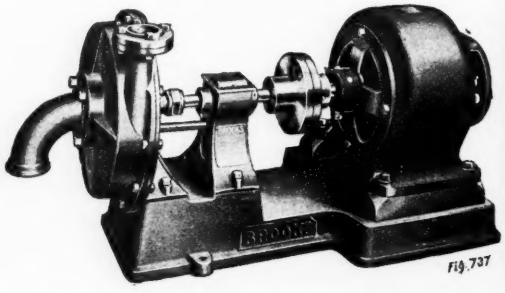


FIG. 3.—BROOKS VARNISH PUMP, WITH CROCKER-WHEELER MOTOR.

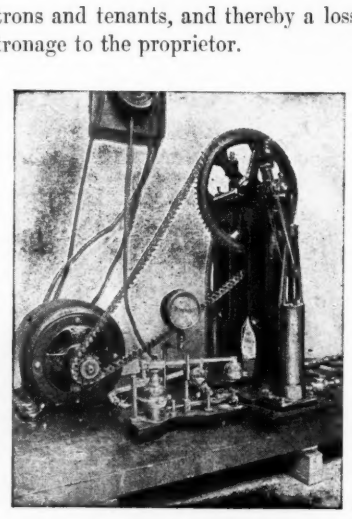


FIG. 6.—BROWN AUTOMOBILE OR BEER PUMP, WITH CROCKER-WHEELER MOTOR.

The accompanying illustrations, supplied by the Crocker-Wheeler Company, Ampere, N. J., show a number of rotary pumps and similar machinery driven by Crocker-Wheeler motors, and illustrate the wide capacity of these motors.

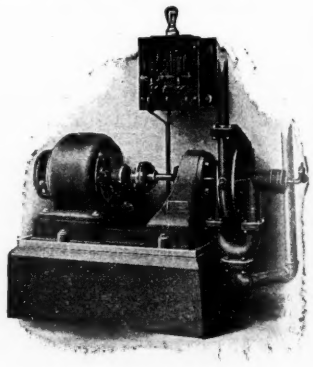


FIG. 4.—CENTRIFUGAL PUMP, WITH CROCKER - WHEELER MOTOR.

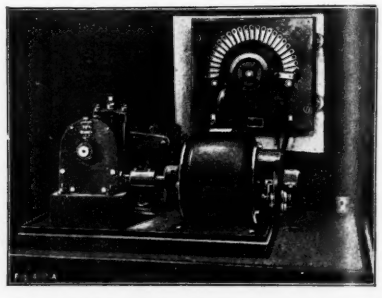


FIG. 5.—ORGAN BLOWER, WITH CROCKER-WHEELER MOTOR.

A New Asbestos Insulating Material.

Asbestos wood, a recent product of the H. W. Johns-Manville Company, New York city, is being largely used as an electrical and fireproof insulating material. Many advantages are claimed for it over marble, slate, fibre and wood, for switchboards, switch bases, insulating pieces, etc., as well as for general fireproof construction. It is easily worked with woodworking tools and can be sawed, nailed or screwed the same as hardwood lumber. It is fireproof, making it especially desirable for all construction where there is danger of short-circuits.

One of the many applications of asbestos wood is in the construction of doors in front of high-voltage transformers and switches in high-tension stations, where an absolutely fireproof and insulating material is essential.

The insulation resistance is extremely high, being almost equal to that of sheet mica. Asbestos wood has a smooth surface and will take any kind of finish that may be desired. For electrical purposes it is regularly furnished in ebony finish.

Meeting of Iowa Associations.

The Iowa Electrical Association opened its eighth annual convention on April 22 at the Savery Hotel, Des Moines, Iowa. About 200 electrical men were in the city to attend the convention, and many of these delegates also participated in the convention of the street railway and interurban men of Iowa, which began on April 23. The electrical convention closed their sessions on April 24.

In connection with the convention of the electrical men, manufacturers of electrical appliances from all parts of the country had a large display of electrical machines and fixtures in the large club room in the Savery Hotel.

Two sessions of the convention were held and papers on electrical subjects were read. Among them were the following:

Opening address by President George S. Carson, of Iowa City.

"Popularizing the Use of Electricity," by E. L. Callahan, of Chicago.

"Fraternalism," by Gus Lundgren, of Cherokee.

"Tact and System," by J. W. Ferguson, of Chicago.

"Economical Operation of a 200-kilowatt Station," by Austin Burt, of Waterloo.

"Grounded Secondaries," by Thomas Sloss, of Cedar Rapids.

"Incandescent Lamp Development," by F. W. Wilcox, of Harrison, N. Y.

At the session on Thursday morning E. G. Wylie, freight commissioner of the Greater Des Moines committee, read a paper on the freight question.

A biennial electric show in Des Moines, backed by the electric lighting companies of Iowa and the electric and interurban railways of the state, was launched at the Thursday session of the Iowa Street and Interurban Railway Association.

The show will be held in the new Coliseum for four days, commencing on the third Tuesday in April of each even-numbered year. This will bring the first show to Des Moines in 1910.

Secretary Geis Botsford, of the Commercial Club, presented the project to the convention. His suggestion was that the electrical and street railway associations hold joint sessions in Des Moines every second year, and that the convention be held in the odd-numbered years in the several cities of the state. His proposal was that the Coliseum be supplied to the association as a meeting place for the sessions, and that the big arena of 22,000 square feet be given over to the electrical show. The plan is to issue courtesy admissions to the exhibitors for distribution to the patrons and to all members of the two associations, and to charge a nominal admission fee to the general public, supplementing the exhibit of electrical devices with a musical programme each afternoon and evening.

General Manager L. D. Mathes, of the Dubuque Lighting and Street Railway Company; President Hippee, of the Des Moines City Railway Company, and others spoke of the plan, giving it their endorsement, and upon motion of Mr. Hippee the association voted to bring the meeting to Des Moines each second year and to take up and promote the electrical show project.

The matter had already been taken up with the officials and members of the Iowa Electrical Association and with a large number of the supply men, and it received their endorsement.

The show will have the support and backing of all the electric lighting and street car and power companies in the state. It will consist of exhibits of all of the various electrical devices for lighting, furnishing power, traction service, etc., as well as of illuminated signs and decorative devices. It is the intention of the two associations to put on a show that will attract a state-wide attendance, made up of all persons interested in electricity as a lighting medium and a motive power.

The railway association adjourned its convention after electing officers and selecting Cedar Rapids as the place for the annual convention next year. The members of the convention were the guests of General Manager Blake, of the Fort Dodge, Des Moines & Southern Interurban Railway on Friday afternoon in a trip to Ames.

The following officers were elected:

President—P. P. Crafts, of Clinton.

Vice-President — R. A. Leussler, of Omaha.

Secretary and treasurer—L. D. Mathes, of Dubuque.

Canadian Crocker-Wheeler Company, Limited.

The Canadian Crocker-Wheeler Company, Limited, has been organized in Canada for the manufacture and sale of Crocker-Wheeler apparatus. The Crocker-Wheeler Company, Ampere, N. J., manufactures all types of direct-current and alternating-current motors and generators, power transformers, motor-generator sets, frequency changers, etc.

F. E. Lovell, president of the new company, is a member of the old-established lumber firm of H. Lovell & Sons, of Coaticook, Quebec, which has extensive interests in mills and timber limits throughout the province of Quebec. Russell A. Stinson and F. J. Bell, vice-president and secretary, respectively, have been identified with the manufacturing, construction and sales ends of the electrical trade in Canada for the past fifteen years, and are particularly well known in Montreal, where the head office of the company has recently been opened in the Street Railway Chambers, Place d'Armes Hill.

An Impostor Working the Electrical Field.

A man giving his name as George Williams, and stating that he is connected with the Brenham-Compress Oil and Manufacturing Company, Brenham, Tex., has approached several electrical companies, including some dealers in Buffalo, N. Y., with the evident intention of defrauding them. One of his methods has been to place a substantial order for electrical material, with which he seems to be thoroughly familiar, and after offering checks and referring to his credit with Texas banks, he attempts to borrow money.

Subsequently, it has turned out that his checks offered in payment are not covered by the local banks in which he claimed he had deposited, or would deposit, money to cover his purchases.

The man did not deposit the funds as promised, and used the receipts for the checks in an attempt to secure more material from another dealer.

This man is described as about five feet nine, stocky build, weighing about 170 pounds; has light hair, blue eyes, smooth face, large, rough, weather-beaten features; upper front tooth broken or missing, wore a soft hat and dressed in general western style.

National Electric Company Bankruptcy Ready to Be Closed.

John I. Beggs, trustee of the bankrupt National Electric Company, has filed his final report, and that estate is now ready to be closed. The final supplemental report of the trustee shows cash on hand for distribution as dividends amounting to $4,032.56. This will admit of the declaration of a third dividend of about one-third of one per cent. Dividends of forty and one-half per cent were formerly declared to creditors.

The National Electric Company was placed in bankruptcy in June, 1905. Total claims of $1,092,000 were filed by creditors, but a large majority of them, or $1,051,324.35, were bought up by the Standard Trust Company, of New York, which concern paid fifty per cent of their face value to the original claimants. After these claims had been bought up, the bankrupt concern was reorganized. The amount realized by the trustee from the assets of the company was $1,503,500.83.

Current Electrical News

DOMESTIC AND EXPORT.

UNION ELECTRIC LIGHT AND POWER COMPANY—N. W. Harris & Company have concluded negotiations with the North American Company for the purchase of $5,500,000 refunding mortgage five per cent bonds of the Union Electric Light and Power Company of St. Louis, Mo. This company is controlled by the North American Company and does practically all the electric light and power business in St. Louis.

NEW CALIFORNIA POWER PLANT—It is planned to build a power plant at Big Flat, on Trinity River, Cal., to generate 4,000 horse-power. The surveys are made and the plans drawn. Construction will begin as soon as the financial end of the project is provided for. Water in Cut Throat Gulch will be utilized. A dam will be thrown across the gulch, creating a large storage reservoir. Cut Throat Gulch is three miles down the river from North Fork, which is at the end of the wagon road. Big Flat is six miles down the stream from Cut Throat Gulch. The Big Flat power-house will be about fifteen miles down Trinity River from the Junction City Plant. Current will be transmitted to Eureka, Humboldt, and the surrounding territory.

ATLANTIC CITY ELECTRIC BOND SALE—The Atlantic City Electric Company, Atlantic City, N. J., has sold to Edward B. Smith & Company, bankers, New York city, $1,000,000 first and refunding mortgage five per cent gold bonds. The bonds are guaranteed for principal and interest by the American Gas and Electric Company, which is controlled by interests affiliated with the General Electric Company. They are part of an authorized issue of $6,000,000, of which $3,750,000 will be reserved for future extensions and the balance to take up a small amount of underlying bonds. The Atlantic City Electric Company controls all the public lighting business of Atlantic City. It is a consolidation of four companies, three of which have perpetual franchises, and one a franchise for 100 years. The net earnings of the company in 1907 were $131,846, or more than double the interest charges. The American Gas and Electric Company, which guarantees the bonds, owns plants in nine other cities. It paid dividends of $71,851 on its preferred stock in 1907 and credited its surplus account $192,988.

NEW WASHINGTON ELECTRIC ROAD—Colonel A. M. Dewey, president and general manager of the Okanogan Electric Railway Company, has received advices from Charles M. Meeker, a representative of English capitalists, that a $3,000,000 bond issue will be taken over by foreign investors. The money will be used in the construction of a standard-gauge electric railroad between Nighthawk and Brewster, in Okanogan County, Wash., northwest of Spokane, seventy-five miles, and eventually will be extended to Spokane from Brewster, 175 miles. Mr. Dewey gave out this statement: "The road will extend from Nighthawk, in the northern part of Okanogan County, to Brewster, in the extreme southern part of the county, the head of navigation of the Columbia River. Construction work will be started at the middle and at both ends of the line before July 1, if we can get the necessary labor, and it is expected that passenger and freight trains will be running in eighteen months from the time work is begun. The road, including equipment, will cost $30,000 a mile. We have already secured contracts for a large part of the right of way and have a site for a power plant at Blue Lake which will develop 5,600 horse-power. An auxiliary plant will be erected at the conjunction of the two forks of Simon Creek, near Conconully. The stream has a fall of 1,200 feet in the Peacock Mountains. After the water is used to generate electrical power it will be turned back into a reservoir for irrigation purposes." The Okanogan country has within its confines several of the largest mines in Washington, the owners of which are negotiating with the company for the haulage of sixty cars of ore a day. The company plans to supply electrical power to irrigate 6,000 acres on the Okanogan River by lifting the water 100 feet to reach the land on two benches.

NEW INCORPORATIONS.

MADISON, WIS.—Athens Telephone Company. Capital increased from $6,000 to $10,000.

DOVER, DEL.—Landers Power Company. $100,000. To dispose of water, water rights, water power and to supply electric current.

MADISON, WIS.—The Kegonsa Independent Telephone Company, Stoughton. An amendment increasing its capital from $3,000 to $5,000.

COLUMBUS, OHIO—The Hydro-Electric Company, Warren. $100,000. C. M. Wilkins, O. D. Morgan, D. E. Hoover, C. R. Seigfried and Henry Herbert.

LANSING, MICH.—Farmers' Independent Telephone Company, Temperance; $5,000. Utica Electric and Water Company; capital increased from $22,000 to $30,000.

DOVER, DEL.—Eastern Oregon Power Company. $2,500,000. Incorporators: S. B. Merrick, Ivy, Va.; F. A. Bingham, Chicago, Ill.; H. W. Davis, Wilmington, Del.

COLUMBUS, OHIO—Excelsior Electric Company, Cleveland. $10,000. Incorporators: Fred Desberg, C. L. Smith, F. A. Waddell, Annette Newman and L. S. Desberg.

MADISON, WIS.—The General Railway Signal Company, Rochester, N. Y. $5,000,000, of which $25,000 is represented by property and business in Wisconsin.

INDIANAPOLIS, IND.—South Bend & Logansport Railway Company. To operate a street and interurban company from South Bend through Lakeville, La Paz, Plymouth, Argos and Rochester to Logansport. $10,000. Directors: T. P. Moredock, H. C. Snell and Frank Rogers, and others.

AUGUSTA, ME.—The Rockport, Shenandoah & Des Moines Railway Company. To own, construct and operate railroads and other transportation systems with terminals, telephones and all other necessary or desirable auxiliaries. $1,000,000 common and $250,000 preferred. J. Berry, president and treasurer; Lewis A. Burleigh, clerk.

AUGUSTA, ME.—Upper Iowa Light and Power Company, Portland. To own, acquire, establish and operate plants for the distribution of light, power and heat, and to do a transportation and auxiliary business. $305,000, divided into $225,000 common and $80,000 preferred stock. James E. Manter, president; Clarence E. Eaton, treasurer; Millard W. Baldwin, of Portland, clerk.

NEW PUBLICATIONS.

COMPARATIVE TESTS OF CARBON, METALLIZED CARBON AND TANTALUM FILAMENT LAMPS—The engineering experiment station of the University of Illinois, Urbana, Ill., has issued bulletin No. 19, containing a report of T. H. Amrine on "Comparative Tests of Carbon, Metallized Carbon and Tantalum Filament Lamps." This gives the results of life tests, performance tests, measurements of temperature, and wave-lengths of these various types of lamp.

FUEL TESTS—The United States Geological Survey, Department of the Interior, Washington, D. C., has issued a report of the fuel-testing plant operated at St. Louis, Mo., from January 1, 1906, to June 30, 1907. This contains an outline of the work by Dr. J. A. Holmes, who is in charge, and the following subsidiary reports: "Field Work," by E. W. Parker and J. S. Burrows; "Work of the Chemical Laboratory," by N. W. Lord; "Steaming Tests," by L. P. Breckenridge; "Producer-Gas Tests," by R. H. Fernald; "Washing Tests," by G. R. Delamater; "Cooking Tests," by A. W. Belden; "Cupola Tests on Coke," by R. Moldenke, and "Briquetting Tests," by C. T. Malcolmson. There is also a summary of these tests by states. Certain of the subsidiary reports have already been noted in the ELECTRICAL REVIEW.

ELECTRIC RAILWAYS.

ATHOL, MASS.—The Athol, Templeton & Gardner Street Railway will make extensive repairs to its road-bed.

MATTOON, ILL.—The Decatur, Sullivan & Mattoon Interurban Company has formally accepted the franchise granted it by this city and the work of building will be turned over to a construction company at once.

NORTH YAKIMA, WASH.—The city council of Yakima City has granted a franchise to the Yakima Valley Transportation Company to operate street cars over designated streets of that city. The railway company is now preparing to extend its lines.

NEW YORK, N. Y.—At the annual meeting of the New York Connecting Railway Company, Ralph Peters and John T. Stevens were elected directors to succeed Thomas R. Rea and Charles S. Mellen, respectively. Other directors were re-elected.

EVANSVILLE, IND.—The Evansville Terminal Railway Company, recently organized to build a traction line from here to Newburg, Ind., has mortgaged its property to the American Trust and Savings Company to secure an issue of $300,000 five per cent gold bonds.

BILLINGS, MONT.—It is stated that an electric railroad will be constructed between Cook City and Columbus in the near future. The distance between the two towns is about sixty miles. Money is said to have been promised by men in the East. The proposed electric line would open up a region rich in stock, agricultural and mineral resources.

ATTLEBORO, MASS.—Attleboro is to have another electric car line to Pawtucket, making four in all, the Interstate Company having awarded the contract for extending its county street line to South Attleboro, where connections will be made with the North Attleboro-Pawtucket line. The work will cost $65,000 and cars will be running August 15.

JOLIET, ILL.—President H. A. Fisher, of the Joliet & Southern Traction Company, announces that the company will extend its line this season from New Lenox to Frankfort, a distance of seven miles, and, in all probability, as far as Chicago Heights, twelve miles further. The substation apparatus necessary will be of the General Electric Company's make.

DUBUQUE, IOWA—A change in the plans of the Dan Patch air line electric road, now in process of construction between Dubuque and Minneapolis, is announced. The crews at work on the north end of the line have been transferred to Dubuque and active end of construction begun from there. Six hundred thousand dollars will be put into the local end of the work at once.

AUSTIN, TEX.—Captain James A. Baker, of Houston, and W. A. Hanger, of Fort Worth, have prepared an amendment to the articles of incorporation of the Northern Texas Traction Company, which company operates an interurban line between Dallas and Fort Worth. The amendment increases the capital stock by $500,000, making a total of three million dollars.

INDIANAPOLIS, IND.—It is announced that work on the proposed line from Kokomo to Terre Haute—104 miles—to serve the towns of Frankfort, Crawfordsville and others, will be started this summer. It will parallel the Chicago, Cincinnati & Louisville Railroad from Kokomo to Frankfort, and from Frankfort to Terre Haute it will parallel the Vandalia Railroad.

SALINA, KAN.—The Salina Street and Interurban Company, which is now operated by gasolene power, will be equipped with electric power at once, the contracts for the equipment having been signed by the president, Robert A. Handy, of Denver, Col. Several new cars have been purchased and the work will begin at an early date and will be completed in sixty days.

BALTIMORE, MD.—Residents and property owners along the Philadelphia road are taking steps to build a trolley road at a cost of $60,000. The project has been taken up and endorsed by the Philadelphia Grange. Already $10,000 has been subscribed, and it is hoped that within the next few weeks enough money will be forthcoming to insure the success of the enterprise.

MARYSVILLE, CAL.—It is understood that the $250,000 necessary to build the Marysville & Colusa branch of the Northern Electric Railway has been raised and work will begin within a few weeks. As soon as this work is well under way it is said work will begin on the extension of the road north to Red Bluff and Redding, probably on the west side of the Sacramento River.

SIOUX CITY, IOWA—The Sioux City Traction Company has filed with the city council a resolution asking for the calling of a special election at which a special ordinance providing for extension and renewals of street franchises will be voted on. The company has withdrawn its offer to build overhead tracks over Wall street, but will contribute $25,000 toward the building of a general viaduct.

CHESANING, MICH.—J. A. Thick, Detroit electric railway promoter, has received a franchise from Chesaning for his Saginaw, Owosso & Lansing electric line. It is believed the road will be built this summer, as Thick is busy buying the few remaining strips to make a complete right of way from Saginaw to Lansing. Several thousands of dollars have already been spent on the projected line.

CHISHOLM, MINN.—Manager R. F. Berdie, of the Northern Traction Company, states that the company will start laying the tracks and grading the road at once. The company has about one mile of road built. The present plan is to get power from the Northern Power Company. Mr. Berdie also states that cars will be running about August 1. Seventy-five thousand dollars' worth of stock will be placed on the market.

BALTIMORE, MD.—The right of the Maryland Electric Company to use the tracks of the Baltimore & Ohio Railroad in entering Baltimore without getting a terminal franchise has been sustained by the board of estimate upon the recommendation of Deputy City Solicitor Poe. The company was authorized to lay its tracks on Russell street for a distance of three squares. A park tax of nine per cent, amounting to $65 a year, will be charged for the franchise.

COLUMBUS, OHIO—The annual meeting of the stockholders of the Scioto Valley Traction Company will be held in the offices May 5. The meeting will be purely a formal affair and there will be no changes in the officers or directors. The annual reports, it is announced, will show a decided increase in business for the fiscal year which ended March 31, and despite the financial panic will show an increase for every month in the year over the corresponding month in the previous fiscal year.

SOUTH BEND, IND.—Pursuant to a plan formulated some time ago, the following have formed a company for the purpose of constructing an electric railway from South Bend to Logansport, Ind., and have incorporated: Alexis Coquillard, Thomas S. Murdock, Patrick J. Houlihan and Frank Rogers, South Bend, and H. C. Snell, Elkhart. The line will run over the proposed route of the Perley company and will pass through South Bend, Lakeville, Lapaz, Plymouth, Argos, Rochester and Logansport. The capitalization is $10,000.

SPOKANE, WASH.—Assurance has been given settlers on lands under the American Falls Canal, a project covering 65,000 acres between Blackfoot and American Falls, that an electric line will be built in the course of a year to connect the above-mentioned cities. The distance between American Falls and Blackfoot is about fifty miles, and the electric road when in operation will be within reach of many thousands of settlers who now reside in and are coming to this tract. It is believed that eastern capital is behind the enterprise.

SPRINGFIELD, ILL.—The secretary of state has issued a license to incorporate the Woodstock & Sycamore Traction Company. The principal office is in Chicago and the capital stock is $1,000,000. The road is to be constructed from Woodstock, McHenry County, through the counties of McHenry, Kane and DeKalb to Sycamore, DeKalb County. The incorporators and directors are: Clinton G. Lumley, E. C. Spinney, Irving V. Stephens, E. B. Harang, S. H. Rhodes, William L. Abbott, George W. Lyndon, George T. Goodrow, Henry P. Heiser, N. G. Schmitz and Charles A. Spenny.

GLENDORA, CAL.—The Pacific Electric Railway Company, which is building a line from Monrovia to Glendora, in Southern California, has completed a bridge that is constructed almost wholly of reinforced concrete. This structure, which spans the San Gabriel River, is 1,019 feet long, and cost not less than $100,000. The bridge is twenty-six feet in width inside of the parapet walls. It consists of eighteen spans, each fifty feet wide in the clear, and the piers are seven feet in thickness at the springtime line. On an

average, the foundations of these piers rest at a depth of twenty feet below the river beds, and are impregnable to any force of current.

PORTLAND, IND.—Elections have been called in Decatur and Washington townships, and in Berne and Monroe townships, Adams County, for May 4, for the purpose of voting on the question of granting subsidies of $5,000 and $3,000, respectively, to aid in the extension of the Fort Wayne & Springfield traction line south from Decatur to Berne. The intention of the company, as announced, is this summer to extend the line as far as Berne, taking up the right of way through to Richmond, and have all in readiness to build on to Richmond next summer. The company being organized to assist in the financing of the extension is expected to have its plans perfected by that time.

FORT ERIE, ONTARIO—Within a year trolley connections will have been completed between Fort Erie and Ridgway and Point Abino if the Fort Erie Ferry Railway Company builds its extensions within the time allowed for the work in an act passed by the legislature of the Province of Ontario. The extension will give the company a complete trolley system extending along the Canadian frontier from Chippawa to Port Colborne when completed. The route from Fort Erie Beach will be built first and will extend for three miles and a half along the beach to Windmill Point Crossroad. Thence it will proceed along the crossroad for half a mile and diverge on an air line almost to Ridgway, and thence northward to Point Abino. President F. J. Weber, of Buffalo, states that he expects the major part of the construction work will be completed by January, 1909.

PROVIDENCE, R. I.—A meeting of the Ashaway & Westerly Railway Company was held recently for organization and election of officers. The following directors were chosen: Dr. A. B. Briggs, Senator John S. Cole, Leverett E. Briggs, Charles W. Clark, Frank Hill, all of Ashaway or Hopkinton; George N. Burdick, Frank E. Sherman, John W. Sweeney, all of Westerly, and William J. Battey, of New York. The directors subsequently elected the following officers: President, Dr. A. B. Briggs; vice-president, John W. Sweeney; secretary and treasurer, Frank Hill. By-laws were adopted and the company was fully organized. The capital stock was fixed at $50,000. Many subscriptions have already been received and it is expected that the stock will be fully subscribed for within a few weeks. The directors voted to have a preliminary survey made at once on the proposed routes from Ashaway to Westerly, and it is their intention to have the road constructed as soon as possible.

DATES AHEAD.

American Electrochemical Society. Next meeting, Albany, N. Y., April 30-May 2.

Nebraska Electrical Trades Association. First annual electrical show, Auditorium, Omaha, Neb., May 4-9.

Illinois State Independent Telephone Association. Annual convention, Champaign, Ill., May.

Nebraska Electrical Association. First annual meeting, Omaha, Neb., May 6-7.

West Virginia Independent Telephone Association. Annual meeting, Fairmont, W. Va., May 7-9.

Southwestern Electrical and Gas Association. Annual convention, El Paso, Tex., May 7-9.

Railway Signal Association. Next meeting, New York city, May 12.

Grand Rapids Electrical Show Association. First show, Grand Rapids, Mich., May 11-16.

Ohio Society of Mechanical, Electrical and Steam Engineers. Next meeting, Columbus, Ohio, May 15-16.

National Electric Light Association. Annual meeting, Chicago, Ill., May 19-22.

Telephone Association of Texas and Louisiana. Annual meeting, Dallas, Tex., May 25-27.

Oklahoma Electric Light, Railway and Gas Association. Annual meeting, Guthrie, Okla., May 25-27.

American Society of Mechanical Engineers. Semi-annual meeting, Detroit, Mich., June 23-26.

American Society of Civil Engineers. Annual meeting, Denver, Col., June 23-26.

American Institute of Electrical Engineers. Annual convention, Atlantic City, N. J., June 29-July 2.

National Electrical Contractors' Association. Next meeting, Chicago, Ill., July 15.

Michigan Electric Association. Annual meeting, Grand Rapids, Mich., August 18-21.

American Society of Municipal Improvements. Annual meeting, Atlantic City, N. J., October.

TELEPHONE AND TELEGRAPH.

READFIELD, ME.—The Readfield & Winthrop Telephone Company will extend its line over Kent's Hill and through to Augusta.

BATH, N. Y.—It is announced that Canisteo business men have decided to buy out the Bell telephone system and conduct it on a mutual basis.

DANVILLE, IND.—The town board has granted the Farmers' Co-operative Telephone Company a franchise for the operation and erection of a telephone system in Danville for twenty-five years.

LITTLE ROCK, ARK.—The Rector Co-Operative Telephone Company has been chartered with a capital stock of $5,000. J. W. Dollison is president; R. A. Klopem, vice-president, and J. R. Hafford, secretary and treasurer.

GRIFFIN, GA.—H. C. Bridges, who for a number of years has operated the local telephone system at McDonough, has sold the exchange to the Southern Bell Telephone Company. The exchange will be enlarged and improved.

HOPKINSVILLE, KY.—The general council at Hopkinsville has revoked the franchise of the Cumberland Telephone Company, which claims its rights under an old franchise granted the East Tennessee Telephone Company.

HILLSBORO, N. H.—G. W. Lincoln has purchased of the New England Telephone Company all its lines between Concord and Peterboro, N. H., and will operate the same. The line will hereafter be known as the Contoocook Valley telephone line. The ownership of several other lines is in contemplation by the same management.

WARRENSBURG, N. Y.—Ray Rooney, manager of the Warrensburg Telephone Exchange, has arranged with the Hudson River Telephone Company for long-distance connections. The present long-distance connections are made with the Commercial Telephone Company. The change will give patrons of the local exchange better facilities.

LA CROSSE, WIS.—The Bell Telephone Company has completed plans whereby La Crosse will be given the benefit of additional service with surrounding towns. A contract has been made with the Standard company, of Minnesota, which operates a line running through southern Minnesota and Iowa and with the Coon Valley Farmers' Telephone Company which reaches through the tobacco belt of Wisconsin and which will have 300 telephones on its lines.

LEWISTON, MONT.—The Mutual Telephone Company has let the contract for the building of a new line to Windham, extending it from Rooney's northward on the section line and in a northwesternly direction across Louse Creek bench. Numerous farmers living adjacent to the new line will have telephones put in. A line to connect the Murray, Lapham, Porter and other ranches has been projected for some time past. Work will begin as soon as material arrives and the weather permits.

GOLDFIELD, NEV.—General Manager E. J. Nally, of the Postal Telegraph Company, has made arrangements with the Southern Nevada Telegraph and Telephone Company to use the lines of the latter company in Southern Nevada, and closed a contract with local contractors to construct other lines for the Postal company in Nevada. Manager Nally says the Postal Telegraph Company will follow the line of the Santa Fe Railroad to Rhyolite, and from that point will later extend lines into all portions of Nevada.

NEW MANUFACTURING COMPANIES.

TROY, OHIO—The Ohio Electric Specialty Manufacturing Company has been incorporated with a capital of $1,000 by John R. Simpson, W. H. Stillwell, Charles M. Murphy, Alva Collins and John W. Stillwell.

ALBANY, N. Y.—The Electric Welding Company, of Brooklyn, has been incorporated to do construction and repair work. The capital is $24,000, and the directors are: Ove Lange, Christian Nielsen and H. O. Amundsen, Brooklyn.

COLUMBUS, OHIO—Harry Ridgeway, August Schwenck, Boston Medbury, Paul H. Kohn and C. W. Drake have incorporated the Ridgeway Company, of Columbus, with a capital stock of $20,000. The new company will take over the business which has been conducted by Ridgeway & Company in the Columbus Savings and Trust Building and will represent a number of large manufacturers of electrical machinery of all kinds in a new location in North High street.

PERSONAL MENTION.

MR. ROBERT KUHN, of the American Electrical Heater Company, Detroit, Mich., is now making a tour of England and the Continent.

MR. WILLIS A. HOLDEN, of Syracuse, N. Y., has been elected treasurer of the Rochester, Syracuse & Eastern Railroad, vice-A. K. Hiscock, deceased, and Fidelio K. Hiscock has been elected a director.

MR. E. W. RICE, vice-president, and Mr. W. J. Clark, manager of the foreign department of the General Electric Company, have been invited to serve in an official capacity in connection with the International Electrical Exposition at Marseilles, France.

MR. JAMES J. WOOD, inventor of the "Wood" systems, and electrical engineer of the Fort Wayne Electric Works, Fort Wayne, Ind., was married on April 16 to Miss Helen D. Baker, of Fort Wayne. Mr. and Mrs. Wood will visit New York, and will live in Fort Wayne.

MR. PHILIP CROSS, commercial manager of the Denver Gas and Electric Company, has tendered his resignation, effective May 1. Mr. Cross went to Denver eight years ago from the East. He will spend some time in the East, returning to Denver to engage in another enterprise.

MR. R. W. HARRIS, late assistant general manager for the Joplin & Pittsburg Railway Company, has been appointed general manager to succeed P. P. Crafts, resigned. The Joplin & Pittsburg line is a Heim property, construction of which will be completed to Joplin in the course of three months.

MR. HORATIO A. FOSTER, resident engineer in Baltimore for L. B. Stillwell, has been transferred to the New York office, 100 Broadway, joining the forces at that point. He will still continue to look after the work in Baltimore, spending such time there as may be necessary, sharing this supervision with H. S. Putnam on electrical work and with Mr. Van Vleck on the steam end. Mr. Foster has been in charge of the work in Baltimore since it was started a year and a half ago and has carried through to completion the many additions and changes made to the power plants of the United Railways and Electric Company, under the contract with Mr. Stillwell. These included the construction of a power station at Bay Shore, a new summer resort; a new substation in the central part of the city, an addition to one of the outlying substations, rearranging and reinforcing of three existing substations, and the construction and reconstruction of the Pratt street power station. During this period of building the operation of all power plants came under his supervision and the forces were all thoroughly reorganized.

OBITUARY NOTES.

MR. EUGENE MUNSELL, president of the Mica Insulating Company, New York city, died suddenly on Saturday, April 25, at his home in New York.

MR. HENRY ROSWELL HEATH, a well known resident of Brooklyn, N. Y., died on Sunday, April 19, after a long illness at his home, 233 Washington avenue, in his sixty-fourth year. He belonged to an old New England family which figured prominently in Colonial and Revolutionary annals. He served in the Civil war with the Twentieth Massachusetts Volunteers, was wounded at Ball's Bluff and was a prisoner in Libby and Andersonville. At the close of the war he became interested in railroading and was one of the organizers of the Empire Transportation Company. He was president of the People's District Telegraph Company for some years and a director of the Brooklyn District Telegraph Company. He was also president of the Crawford Realty Company and vice-president of the Westcott Truck Company. He is survived by his wife and a son.

ELECTRICAL SECURITIES.

Developments last week in the stock market were entirely of a suggestive character, which had a tendency to produce a better feeling in the financial district. Notwithstanding the reports of slackening of things, industrially, and the clouds which overhung several large corporations, notably Erie, the market showed a remarkable vitality and a disposition to withstand any raiding for a decline in prices. The success of the Pennsylvania bond sale indicates that there is plenty of money available for good investment. Crop indications are still exceptionally favorable, and if reports of the poor outlook abroad are well-founded, the bounteous crops of our own agriculturists will bring a large balance of trade this way.

Dividends have been declared upon the following electrical securities: National Carbon Company; regular quarterly dividend of 1¾ per cent on the preferred stock, payable May 15. American Gas and Electric Company; regular quarterly dividend of 1½ per cent on the preferred stock, payable May 1. Southern Colorado Power Company; a dividend of 1¾ per cent on the preferred stock, payable May 1. Portland (Me.) Electric Company; quarterly dividend of 1½ per cent, payable April 30. American District Telegraph Company; regular quarterly dividend of 1 per cent on the capital stock, payable May 15 to stock of record May 1. Western Electric Company; regular quarterly dividend of 2 per cent, payable May 1. Connecticut Railway and Lighting Company; regular quarterly dividend of 1 per cent on the assenting common stock, 15 cents on the non-assenting common stock and 1 per cent on the preferred stock, all payable May 15. Mexico Tramways Company; quarterly dividend of 1 per cent, payable May 1. Ohio Traction Company; regular quarterly dividend of 1¼ per cent, payable May 1 to stock of record April 30. American District Telegraph Company, of New York; regular quarterly dividend of 1 per cent, payable May 15 to stock of record May 1.

ELECTRICAL SECURITIES FOR THE WEEK ENDED APRIL 25.

New York:	*Closing.*
Allis-Chalmers common	8⅛
Allis-Chalmers preferred	20⅜
Brooklyn Rapid Transit	47
Consolidated Gas	118
General Electric	134¾
Interborough-Metropolitan common	10½
Interborough-Metropolitan preferred	28⅞
Kings County Electric (ex interest)	118
Mackay Companies (Postal Telegraph and Cables) common	61
Mackay Companies (Postal Telegraph and Cables) preferred	65½
Manhattan Elevated	127
Metropolitan Street Railway	29
New York & New Jersey Telephone	105
Western Union	51
Westinghouse Manufacturing Company	56½

Boston:	*Closing.*
American Telephone and Telegraph	119
Edison Electric Illuminating	212½
Massachusetts Electric	46
New England Telephone	114
Western Telephone and Telegraph preferred	65

Philadelphia:	*Closing.*
Electric Company of America	9½
Electric Storage Battery common	29½
Electric Storage Battery preferred	29½
Philadelphia Electric	7⅞
Philadelphia Rapid Transit	17⅞
United Gas Improvement	79⅞

Chicago:	*Closing.*
Chicago Telephone	—
Commonwealth Edison	—
Metropolitan Elevated preferred	47½
National Carbon common	56
National Carbon preferred	110

EDUCATIONAL NOTE.

PURDUE UNIVERSITY—Purdue University, Lafayette, Ind., has issued its annual catalogue for 1907-1908. This contains descriptions of courses of instruction offered at the university, the requirements for admission, general information and a register of students. The latter shows that there are during the present year 2,085 students studying at Purdue.

ELECTRIC LIGHTING.

GRIDLEY, CAL.—The recent election resulted in a victory for the municipal ownership of electric light and water systems.

REPUBLIC, WASH.—H. D. Merritt, of Spokane, is endeavoring to secure a franchise at Republic for a water and electric light plant.

SACRAMENTO, CAL.—At a meeting of the state prison directors it was decided to advertise for bids for the construction of an electric lighting plant for Folsom state prison, to cost $6,000.

PLAQUEMINE, LA.—J. Savage, the constructor of the Plaquemine Electric Light and Power Company and the controlling stockholder, has sold his interests to N. P. Conery, of New Orleans.

LIMA, OHIO—The ordinance providing for the establishment of a municipal lighting plant has been passed by the city council. This provides for the issuance of $80,000 in bonds for the purpose.

NEVADA CITY, CAL.—After over two years of work the Deer Creek power plant, eight miles east of here, has been completed. The California Gas and Electric Corporation met with many obstacles in building the plant.

BOSTON, MASS.—The Gas and Electric Light Commission has authorized the Edison Electric Illuminating Company, of Brockton, to issue $100,000 five-per-cent bonds, the proceeds to be used to cancel outstanding promissory notes.

LAURENS, S. C.—The city council has closed a ten-year contract with the Reedy River Power Company for supplying the city of Laurens with electricity. The contract calls for a minimum of 133 horse-power at a rate of $50 per horse-power.

LOUISVILLE, KY.—The so-called Fetter electric lighting franchise which was passed by the general council and signed by the mayor, will be sold at public auction May 12. The franchise covers a portion of the business section of the city only.

ANTIOCH, CAL.—The surveyors of the Great Western Power Company, which is building a line from its power-generating station above Oroville to Oakland, have returned to this vicinity and are now at work. The surveyors were forced to cease operations last fall because of the flooded conditions of the low lands about Brannan Island.

FULLERTON, KY.—The Fullerton Light and Power Company has been incorporated with the following officers: Frank Swearngin, president; Albert Smith, vice-president, and Elizabeth L. Swearngin, secretary and treasurer. The plant will be located in Smith's planing mill, and will furnish light for three towns, South Portsmouth, Springville and McCall.

RICHMOND, ME.—The Richmond Electric Light Company has organized with the following officers: President, Hon. C. D. Newell; vice-president, George Fish; clerk, Henry C. Reed; treasurer, Henry E. Houdlett; board of directors, Charles B. Day, J. Clark Flagg, T. J. Southhard, T. G. Herbert, George Fish, Henry Houdlett, W. N. Price, H. C. Reed and C. D. Newell.

PEKIN, ILL.—The Manito village board has voted to bond the town for $3,500 and assume the control of the electric light plant. This was started by J. N. Smith, but with the poles set and a part of the machinery in place, operations ceased. The village will pay Mr. Smith from $1,600 to $1,650 for his investment and advertise for bids for the completion of the plant.

TALLADEGA, ALA.—The stockholders of the Alabama Power Development Company held a meeting in Talladega and elected the following board of directors: J. H. Hanson, New York, president; R. A. Mitchell, Gadsden, vice-president; J. K. Dixon, Talladega; James D. Mortimer, A. E. Smith, H. H. Dean, R. J. McClelland, H. M. Francis and G. J. Anderson, New York.

NASHVILLE, TENN.—A company has been organized at Lewisburg with a capital stock of $10,000 to build and operate a new electric light plant for that city. The electricity will be generated by water power at Lillard's Mill on Duck River. S. T. Hardison, G. F. Hardison, R. C. Armstrong, E. L. Asehiem and J. B. Hardison are the incorporators and the men behind the enterprise.

MADISON, WIS.—The Railroad Rate Commission has authorized the Menomonee Falls Electric Lighting Company to issue $10,000 of common stock and $6,000 par value bonds to be used for enlarging the plant. The application was made by R. G. Wagner and J. G. Creamer, Milwaukee, and J. B. Whittaker, Menomonee Falls, owners. The plant was valued by the commission at $6,500.

MACON, GA.—An application for a charter has been filed with the Superior Court of Macon by Attorney Walter Grace, of the Citizens' Electric Company. The company was granted a Macon franchise several months ago by the city council. The company has been given a right to use the streets of the city provided a charter be obtained in a certain length of time and work commenced before December 1.

NORTH BUTTE, MONT.—The North Butte Extension Copper Company, at Butte, has made a contract with the Butte Electric and Power Company for its requirements for power and light. It is expected that a saving of sixty-five per cent in the copper company's power bills will thus be effected. The Butte Electric and Power Company supplies power to the Butte Street Railway Company and to many of the mines in the vicinity.

ST. LOUIS, MO.—The King Electric Light Company and the Suburban Electric Light and Power Company have filed petitions in the St. Louis County Court, asking that their franchises be extended. The former company asks that it be allowed to seek patronage in all of the county north of the Clayton, the Conway and the Wild Horse Creek roads, while the latter company wants to furnish electricity in the rest of the county.

SPRINGFIELD, ORE.—It is reported that the Willamette Valley Company, which supplies this place and Eugene with electric light and power, is to install an entirely new equipment of engines and dynamos in its generating plant at this place. The horse-power now generated is inadequate to the demands for lighting both the cities, and furnishing power for commercial purposes, the waterworks pumping plants and the Eugene street-car system.

EUGENIA, ONTARIO—A second electric light plant is to be installed on the Beaver River, a short distance below the Georgian Bay Power Company's plant. J. Deagle, of Cataract, representing the Cataract Power Company, who will operate the new plant, has secured the right from the township to erect poles for a transmission line to outside points. If the franchise can be secured Dundalk, fifteen miles distant, will be supplied with electric energy.

UTICA, N. Y.—It is stated by officers of the Hudson River Power Company that the transmission line from Spier Falls, on the upper Hudson River, to this city, will probably be completed in the late summer or fall and that the local trolleys will thereafter be operated by electricity from the plant. The transmission lines which are being built partly by subcontractors and partly by the construction force of the Hudson River company, have been extended as far as Amsterdam.

FORT WORTH, TEX.—George W. Armstrong, president of the Consumers' Light and Heat Company, has filed with the city commission a proposal to combine the two conflicting propositions of public and private ownership of public utilities. The plan proposes to sell the city fifty per cent of the stock of the Consumers' Light Company on the basis of cost, plus eight per cent per annum. The plant is to be controlled by six directors, three to be selected by the city and three by the company. The plan is for the company to install a city lighting plant and a gas plant. The money is to be procured on the notes of the company, the money to be secured by the city.

WENATCHEE, WASH.—W. T. Clark, ex-Mayor Scheble and Marvin Chase have ordered the machinery for the power plant they will install in the Wenatchee Valley this summer. They formed the Valley Power Company a year ago, but nothing definite has been done to establish the company until recently. The company intends to develop a large water-power proposition on the Wenatchee River, five miles above Cashmere, the plant to be near the intake of the high-line ditch canal. The intake of the canal will be moved up the river to give sufficient fall, and the ditch will be widened and given a concrete bed. The object of developing this plant is to furnish power to ranchers to secure water for irrigation. About 4,000 horse-power will be developed and the company will put about $100,000 in the plant. The company expects to be able to deliver power in August.

INDUSTRIAL ITEMS.

THE WELLMAN-SEAVER-MORGAN COMPANY, Cleveland, Ohio, has moved its New York office to the Hudson Terminal Building, 50 Church street.

THE M. W. DUNTON COMPANY, Providence, R. I., announces that its New York representative, W. Timanus McDowell, has moved his office to the Hudson Terminal Building, 50 Church street.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, Rochester, N. Y., is distributing a very interesting folder devoted to standard oak and locust pins and special "Krekose" pins.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., announces the removal of its New York offices from the Edison Building, 44 Broad street, to the Cortlandt Building, 30 Church street. Approximately 31,000 square feet, or the entire seventeenth floor of the Cortlandt Building, will be occupied by the General Electric Company. The Cortlandt Building, with its twin building, the Fulton, comprise the great Hudson Terminal.

THE NATIONAL BRAKE AND ELECTRIC COMPANY, Milwaukee, Wis., has been awarded a contract to furnish all of the air-brake apparatus for 1,200 new cars which will be purchased by the Chicago Railways Company within the next three years. About 550 of these cars will be put in service this summer, orders for 400 cars having already been placed with the car-builders.

DOSSERT & COMPANY, New York city, announce the receipt by the San Francisco Gas and Electric Company of a large shipment of Dossert solderless cable taps, comprising 200 for No. 0000 cable, 100 for No. 0 cable and 100 for No. 2 cable, for its underground department. Dossert & Company have also received a large order for solderless connectors and terminals to be used in the wiring of the new Senate building in Washington, D. C.

THE HOLOPHANE COMPANY, 227 Fulton street, New York city, has published a bulletin devoted to Holophane reflectors for Gem, Meridian, tantalum and tungsten lamps. This bulletin is especially important, as it calls attention to sand-blasted and enameled globes and reflectors, and contains a valuable table showing the different types and sizes of lamps which can be used to advantage with the several styles and sizes of these popular reflectors.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has published an attractive pamphlet devoted to the luminous electric radiator. These radiators consist of an ornamental cast-iron frame fitted with a polished copper reflector at the back, and with three or more large cylindrical incandescent heating lamps. Other bulletins which have been issued by the company are as follows: No. 4,576, devoted to 4,500-volt, oil-break switches, type F, form K-3, for panel installation and remote control; No. 4,578, railway motor controllers; No. 4,579, the luminous arc headlight; No. 4,584, the CQ motor.

THE AMERICAN ENGINE COMPANY, Bound Brook, N. J., has issued bulletin No. 14, devoted to the American-Ball angle-compound engine. This machine represents a great step in advance in the construction of high-speed compound engines. The high-pressure cylinder is horizontal, and the low-pressure, vertical, and the machine embodies a number of characteristics which render it particularly available for the driving of electrical machines. In addition to the descriptive matter there are several fine illustrations showing in detail the various features of construction. Copies of this bulletin will be sent to those interested upon request.

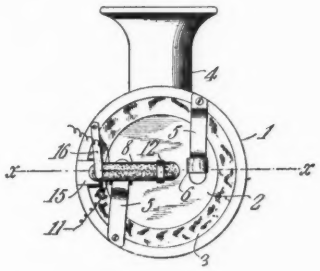
Record of Electrical Patents.

Week of April 21.

885,007. TELEPHONE TRANSMITTER. Alberta Beachum, Polkton, N. C. The microphone granules are enclosed within an exhausted tube.

885,009. INDUCTION MOTOR. Bernard A. Behrend, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. The rotor spider is provided with radial fan blades and supports the short-circuiting rings.

885,017. CANOPY ATTACHMENT FOR LIGHTING FIXTURES. George W. Cassidy, East Orange, N. J. A split-ring canopy.



885,007.—TELEPHONE TRANSMITTER.

885,031. REGULATOR FOR DYNAMOELECTRIC MACHINES. Richard Fleming, Lynn, Mass., assignor to General Electric Company. A vibratory member for varying the resistance in the exciting circuit is controlled by two coils, one responsive to the main potential, and the other, to the current in the exciting circuit.

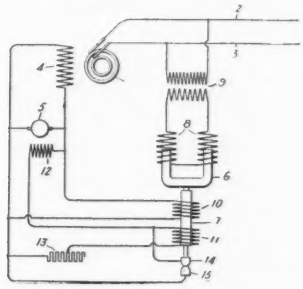
885,034. TRANSFORMER. John J. Frank, Schenectady, N. Y., assignor to General Electric Company. The primary and secondary coils are separated by parallel layers of insulating and conducting material.

885,054. GAS ELEMENT FOR CONVERTING THE ENERGY OF COMBUSTIBLE OR OTHER SUITABLE REDUCING SUBSTANCES TO ELECTRIC CURRENT. Ernst W. Jungner, Kneippbaden, Norrköping, Sweden. A gas battery in which sulfureous acid is oxidized to sulfuric.

885,061. INTERLOCKING RELAY. Thomas L. Lee, Westfield, N. J., assignor to the Hall Signal Company. A relay controlled by two electromagnets, each acting upon its own armature.

885,063. TROLLEY STAND. William A. Loudon, Chicago, Ill., assignor to General Electric Company. The pole, mounted on a standard, can be folded down against the latter.

885,072. ELECTRIC IGNITER FOR GAS OR VAPOR ENGINES. Leon O. McPherson, Highland Park, Ill. The electrodes are separated by an electromagnet.



885,031.—REGULATOR FOR DYNAMOELECTRIC MACHINES.

885,083. ELECTROLYTIC APPARATUS. Brodde E. F. Rhodin, Sault Ste. Marie, Ontario, Canada. A cell consisting of a series of concentric channels arranged stepwise.

885,106. SYSTEM FOR DISTRIBUTION. Lewis L. Tatum, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. A multiple voltage system making use of a two-armature balancer.

885,127. ELECTRIC DISPLAY APPARATUS. Edmund L. Zalinski, New York, N. Y. An arrangement for moving the lamp reflectors to and fro.

885,128. MOTOR CONTROL. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. A controller enabling a commutator motor to be connected as a series machine on direct-current and as an induction motor on alternating-current circuits.

885,143. AUTOMATIC SYNCHRONIZER. Frank Conrad, Swissvale, Pa., assignor to Westinghouse Electric and Manufacturing Company. A pivotally mounted switch which will automatically close the generator circuit at a predetermined phase.

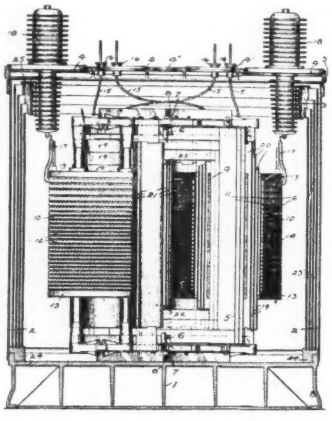
885,147. CONTROLLING DEVICE FOR ELECTRIC MOTORS. Charles A. Dresser, Chicago, Ill., assignor to G. A. Edward Kohler and Franklin W. Kohler, Chicago, Ill. A starting switch controlled by a solenoid, which utilizes the same resistance for forward and reverse running.

885,163. ARMATURE WINDING FOR HIGH-SPEED DYNAMO-ELECTRIC MACHINES. Benjamin G. Lamme, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. There are two sets of end connectors, one arranged in the armature slots, and one not in slots.

885,168. AUTOMATIC SIGNALING DEVICE. Guy Milburn, Baltimore, Md., assignor of one-half to Willard G. Milburn, Baltimore, Md. A block signaling system operated by electromagnetic means on the locomotive.

885,180. TELEPHONE TRUNKING SYSTEM. Edwin H. Rupe, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. The connection with the ringing key is governed by the character of the jack into which the plug is inserted.

885,184. WINDING FOR DYNAMOELECTRIC MACHINES. Walter Schmidt, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. The coils are divided into two groups, in one of which the end characters are arranged in edgewise relation, and in the other, in sidewise relation.



885,034.—TRANSFORMER.

885,186. THREE-WIRE CENTRAL-ENERGY TELEPHONE SYSTEM. Charles A. Simpson, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. A third conductor, isolated from the talking circuit, contains a supervisory signal.

885,246. ELECTRIC FIXTURE. Harry T. Hall, Greenville, Ohio. An adjustable reel for cord fixtures.

885,255. MAGNETOELECTRIC MACHINE. Edward B. Jacobson, Pittsfield, Mass., assignor to Pittsfield Spark Coil Company, Pittsfield, Mass. A magneto for ignition purposes.

885,270. TELEPHONE SYSTEM. Frank E. Mayberry, West Medford, and Newman H. Holland, Brookline, Mass., assignors to Boston Telephone Selector Company, Boston, Mass. A selective party-line system.

885,278. COMMUTATOR WIPER AND OILER. Daniel D. Neville, George H. Clay and John H. Clewer, Kansas City, Mo.; said Clewer assignor to C. M. Hanks, Kansas City, Mo. A coil and plunger electromagnet periodically presses an oiled wiper against the commutator.

885,280. ACTUATING MECHANISM FOR FARE REGISTERS. John F. Ohmer, Dayton, Ohio, assignor to Ohmer Fare Register Company, Rochester, N. Y. A fare register actuated by an electromagnet.

885,338. ARC LAMP. Johannes Härdén, Schenectady, N. Y., assignor to General Electric Company. A form of arc lamp suitable for use with metallic electrodes.

885,348. TELEPHONE HOOK SWITCH. Herbert L. Knight, Cleveland, Ohio, assignor, by mesne assignments, to Century Telephone Construction Company, Buffalo, N. Y. The hook controls the switch connections by means of a plunger.

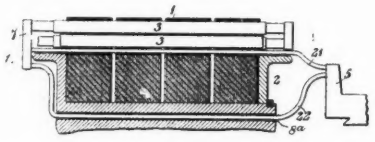
885,367. RAILWAY SIGNAL AND TELEPHONE SYSTEM. Frederick L. Odenbach, Cleveland, Ohio, assignor of one-half to John C. Poore, Cleveland, Ohio. A system utilizing one rail and a line conductor.

885,368. ICE CLEANER FOR TROLLEY POLES. Jacob M. Olinger, Springfield, Ohio. A harp provided with scraping edges.

885,375. COIN BOX AND REGISTERING MECHANISM FOR TELEPHONES. Frank D. Powell and Charles S. Ellis, Chicago, Ill., assignors to American Coin Register Company. The motion of the actuator for moving the coin from a primary to a secondary stage is controlled by an electromagnet.

885,394. APPARATUS FOR CONVERTING DIRECT CURRENT INTO ALTERNATING CURRENT. Frederick F. Strong, Boston, Mass. A rotary commutator and slip rings.

885,400. ELECTRIC ARC LAMP FOR ALTERNATING CURRENTS. Géza Szuk and Wenzel Hackl, Budapest, Austria-Hungary. A lamp with a tubular main body.



885,163.—ARMATURE-WINDING FOR HIGH-SPEED DYNAMOELECTRIC MACHINES.

885,417. ELECTRICALLY OPERATED PUNKA AND THE LIKE. Harry H. Young, Colchester, England, assignor to himself, and Bergtheil and Young Limited, London, England. A swinging motion is secured through a friction drive.

885,429. TELEPHONE TOLL BOX. Odilon Brisbois, Chicago, Ill., assignor of one-third to Richard W. Poelma and one-third to Martin Dahl, Chicago, Ill. A turnstile, operated by the coin, is locked by an electromagnet.

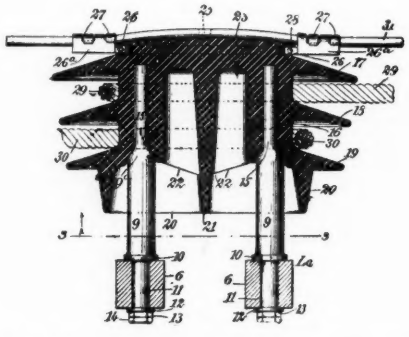
885,430. THERMOELECTRIC COUPLE. William H. Bristol, New York, N. Y. One electrode is formed of pure, and the other of impure, carbon.

885,446. CONTROLLER. Arthur T. Crocker, Schenectady, N. Y., assignor to General Electric Company. A controller for a unit-switch system.

885,476. MOTOR-CONTROLLING SYSTEM. Arthur E. Hogrebe and Victor O. Strobel, Philadelphia, Pa., assignors to Niles-Bement-Pond Company, Jersey City, N. J. The motor armature is short-circuited before reversing.

885,513. ELECTRIC TIME-SWITCH. Carl G. Nylander and Frank J. Regensburger, McKeesport, Pa., assignors to National Electric Time Switch Company, McKeesport, Pa. A service switch controlled by a clock.

885,519. ELECTRIC SIGNAL. John Rebar, Smithdale, Pa. The contacts for the signaling circuit are mounted on the sides of the car couplers.



885,678.—INSULATOR FOR HEAVY CURRENTS.

885,545. TELEGRAPH SOUNDER. James J. Thomas, Whiting, Iowa, and Albert G. Christopherson, Scribner, Neb. The electromagnet is mounted on a pivoted lever.

885,562. SECONDARY BATTERY. William A. F. Alt, Brooklyn, N. Y., assignor, by mesne assignments, to American Battery Company, Cedarhurst, N. Y. A battery formed of one large plate and a plurality of smaller ones of opposite sign.

885,678. INSULATOR FOR HEAVY CURRENTS. Louis Steinberger, New York, N. Y. A hollow insulator with a plurality of supports.

885,688. RELAY. Archibald S. Cubitt, Schenectady, N. Y., assignor to General Electric Company. A relay of the coil and plunger type, means being provided for shunting more or less of the magnetic flux.